**Acerca de este libro**

Esta es una copia digital de un libro que, durante generaciones, se ha conservado en las estanterías de una biblioteca, hasta que Google ha decidido escanearlo como parte de un proyecto que pretende que sea posible descubrir en línea libros de todo el mundo.

Ha sobrevivido tantos años como para que los derechos de autor hayan expirado y el libro pase a ser de dominio público. El que un libro sea de dominio público significa que nunca ha estado protegido por derechos de autor, o bien que el período legal de estos derechos ya ha expirado. Es posible que una misma obra sea de dominio público en unos países y, sin embargo, no lo sea en otros. Los libros de dominio público son nuestras puertas hacia el pasado, suponen un patrimonio histórico, cultural y de conocimientos que, a menudo, resulta difícil de descubrir.

Todas las anotaciones, marcas y otras señales en los márgenes que estén presentes en el volumen original aparecerán también en este archivo como testimonio del largo viaje que el libro ha recorrido desde el editor hasta la biblioteca y, finalmente, hasta usted.

**Normas de uso**

Google se enorgullece de poder colaborar con distintas bibliotecas para digitalizar los materiales de dominio público a fin de hacerlos accesibles a todo el mundo. Los libros de dominio público son patrimonio de todos, nosotros somos sus humildes guardianes. No obstante, se trata de un trabajo caro. Por este motivo, y para poder ofrecer este recurso, hemos tomado medidas para evitar que se produzca un abuso por parte de terceros con fines comerciales, y hemos incluido restricciones técnicas sobre las solicitudes automatizadas.

Asimismo, le pedimos que:

+ *Haga un uso exclusivamente no comercial de estos archivos* Hemos diseñado la Búsqueda de libros de Google para el uso de particulares; como tal, le pedimos que utilice estos archivos con fines personales, y no comerciales.

+ *No envíe solicitudes automatizadas* Por favor, no envíe solicitudes automatizadas de ningún tipo al sistema de Google. Si está llevando a cabo una investigación sobre traducción automática, reconocimiento óptico de caracteres u otros campos para los que resulte útil disfrutar de acceso a una gran cantidad de texto, por favor, envíenos un mensaje. Fomentamos el uso de materiales de dominio público con estos propósitos y seguro que podremos ayudarle.

+ *Conserve la atribución* La filigrana de Google que verá en todos los archivos es fundamental para informar a los usuarios sobre este proyecto y ayudarles a encontrar materiales adicionales en la Búsqueda de libros de Google. Por favor, no la elimine.

+ *Manténgase siempre dentro de la legalidad* Sea cual sea el uso que haga de estos materiales, recuerde que es responsable de asegurarse de que todo lo que hace es legal. No dé por sentado que, por el hecho de que una obra se considere de dominio público para los usuarios de los Estados Unidos, lo será también para los usuarios de otros países. La legislación sobre derechos de autor varía de un país a otro, y no podemos facilitar información sobre si está permitido un uso específico de algún libro. Por favor, no suponga que la aparición de un libro en nuestro programa significa que se puede utilizar de igual manera en todo el mundo. La responsabilidad ante la infracción de los derechos de autor puede ser muy grave.

**Acerca de la Búsqueda de libros de Google**

El objetivo de Google consiste en organizar información procedente de todo el mundo y hacerla accesible y útil de forma universal. El programa de Búsqueda de libros de Google ayuda a los lectores a descubrir los libros de todo el mundo a la vez que ayuda a autores y editores a llegar a nuevas audiencias. Podrá realizar búsquedas en el texto completo de este libro en la web, en la página `http://books.google.com`

This is a reproduction of a library book that was digitized by Google as part of an ongoing effort to preserve the information in books and make it universally accessible.

Google™ books

https://books.google.com

Digitized by Google

Per. 18611 e. 151
1-2

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

THE

# PENNY MECHANIC;

## A MAGAZINE

OF THE

## ARTS AND SCIENCES.

VOL. I.—1837.

ILLUSTRATED BY MR. G. H. WALL.

BODLEIANA RADCLIVIANA

LONDON:

PUBLISHED BY D. A. DOUDNEY,

AT THE HOLLOWAY PRESS;

BERGER, HOLYWELL-STREET, STRAND;

AND MAY BE HAD OF ALL BOOKSELLERS.

Digitized by Google

HOLLOWAY PRESS:
D. A. DOUDNEY.

Digitized by Google

# PREFACE.

THE Editor of the "PENNY MECHANIC" gladly avails himself of the opportunity afforded by the publication of the first Volume, to thank his readers for the kind and active support he has received from them, and also to congratulate them on the success that has attended both his and their exertions. The want of such a work had long been felt by a large class of operatives, and its success may principally be attributed to the fact, that it has, to a certain extent, at least, been the means of supplying this want. It has been the anxious endeavour of the Editor to bring before his readers only such matter as he thought might prove of practical utility to them; abstruse subjects, that would only prove interesting to a few, have invariably given place to articles which it was thought would prove entertaining and instructive to the many. In taking a summary view of the contents of the Magazine, the Editor refers with pleasure to the many ingenious inventions that have been described. The Arts and Manufactures have not been neglected. Descriptions of many ingenious processes, which it required a work of this kind to make known, have been brought before the reader in a popular manner; and in the succeeding volume of the work, the Editor will endeavour to give descriptions of the more important processes in the arts now carried on in this country. The Student in the Sciences will find many papers in this Magazine worthy his attention. Many ingenious pieces of apparatus have been noticed, and also the mode of constructing various kinds for illustrating facts in experimental philosophy in an economical manner. The best method of conducting various experiments in the Sciences, have likewise been published. The articles on the Phenomena of Nature, and the Biographical Notices of some few eminent men, will not, it is hoped, be without their utility. In endeavouring to advance the social and intellectual improvement of his readers, the Editor has not failed to direct their attention to what he considered inimical to such improvement, as well as to the means by which it might be promoted. The Notices of Lectures at the various Mechanics' Institutions each week, have, he is aware, been the means of inducing very many readers to avail themselves of this means of improving their mental powers. Acting, also, on the principle, true to a certain extent, that one

Digitized by Google

square inch of wood is worth a page of letter-press, every Number has been well illustrated, by which means many complicated pieces of machinery have been explained, that could not have been described without the assistance of the draughtsman.

The Editor has done all he could to make the work useful to his readers; but of course, at the commencement of every publication, and one like this in particular, many difficulties have to be contended with, which are only to be overcome by time and experience. In conducting the next Volume, these difficulties will no longer impede the Editor, and he will be able to introduce several improvements that have hitherto been impracticable. He depends on the kindness of his readers and correspondents for a continuance of those exertions, to which the success of the Magazine is mainly to be attributed. It is now a publication devoted to the improvement of the working man. His inventions, that otherwise might remain unknown for want of patronage, shall ever receive the best attention of the Editor, and be communicated to the public in a manner calculated to obtain encouragement and support. His queries respecting any process with which it may be necessary that he should become acquainted, and which other working men (readers of the Magazine), may be able and willing to give him information upon, shall always be readily inserted. In short, every thing shall be done that can be done, to render the work useful to him, and it is hoped, in return, that he will endeavour to promote the success of *his own Magazine* as much as possible.

The Editor has to offer his acknowledgments to his numerous correspondents, for their many useful communications, and he trusts that the next Volume will not be less indebted to them for its interest than the present.

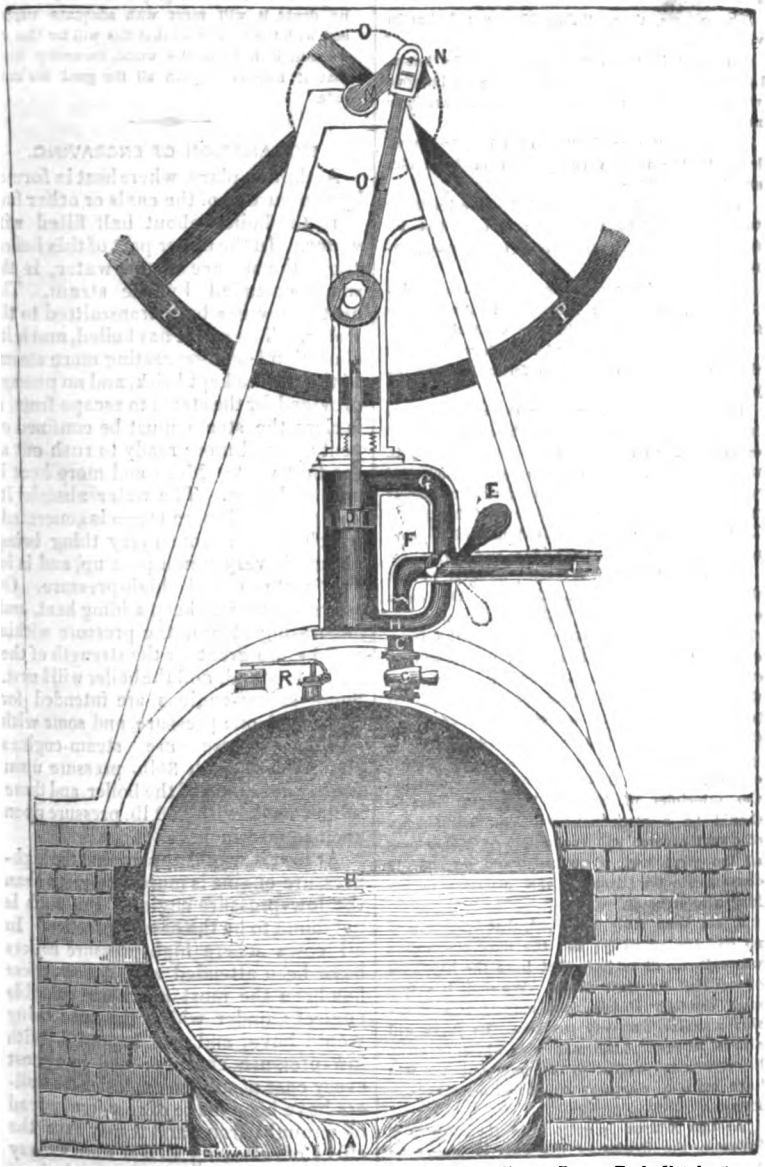
Digitized by Google

# THE PENNY MECHANIC.

## A MAGAZINE OF THE ARTS AND SCIENCES.

No. I.] SATURDAY, NOV. 5, 1836. Vol. I.

### THE HIGH PRESSURE STEAM ENGINE.






Holloway Press: D. A. Doudney.

Digitized by Google

## TO OUR READERS.

On presenting ourselves for the first time before the Public, it is proper, perhaps, that we should briefly state the objects the Magazine will endeavour to accomplish, and thus inform our Readers of the general principle on which it will be conducted.

The objects, then, "The Mechanic" has in view are—

To assist in the diffusion of scientific knowledge amongst the people, and also to improve their social and moral condition by all available means.

To show the application of scientific knowledge to the various occupations of Mechanics and Working Men.

To notice all Inventions and Discoveries likely to prove useful to Artizans, and to collect information that will assist them in their employments.

To report the proceedings of Mechanics' Institutions, and other Educational Associations for the Improvement of the people. And,

To point out to our Readers such works as we think calculated to assist in forwarding the objects we have in view.

For the purpose of carrying the above objects into effect, a portion of the work will be devoted every week to illustrate some branch of Natural Philosophy. Essays on subjects connected with the social and moral condition of Society will also be given, with Reports of interesting Lectures—and miscellaneous information connected with the progress of Science and Art.

We do not think it advisable, however, to confine ourselves to any particular plan. Our earnest endeavour will be to make the Magazine useful and interesting. Without it has the latter quality, we feel assured that its utility will be comparatively trifling: and abstruse subjects will therefore seldom find admission to our pages. It is the general Reader we wish to interest; and this we shall endeavour to do as far as lies in our power. Dr. Arnott has observed, "It is not necessary, in order that a person may understand the principles of Natural Philosophy, that he should be a mathematician. The mathematics of common sense will enable him to comprehend all the great laws of nature;" and we hope to demonstrate the truth of this assertion as the Magazine proceeds.

It has been truly remarked, that Science is of no country, or party; and the same observation will apply to all subjects that have the happiness of mankind for their object. We shall therefore most carefully abstain from making this Magazine a vehicle for party purposes. Its pages will always be open to the man who wishes to make his knowledge useful to others; but we will have nothing whatever to do with party differences.

As this Address is written for the purpose of informing the Reader of the kind of matter he may expect to find in "The Mechanic," and not to claim his support merely on account of our being actuated by an earnest desire to improve the Education of the People, or by any other motive, we think we have stated all that is necessary, "The Mechanic" must advocate its own cause. If such a work is wanted, and if it is conducted in a proper manner, we have no doubt it will meet with adequate support; and with the conviction that this will be the case, we send it forth to the world, earnestly hoping that it may accomplish all the good we anticipate.

## EXPLANATION OF ENGRAVING.

A, the fire-place, where heat is formed by combustion of the coals or other fuel.

B, the boiler, about half filled with water. In the upper part of this boiler, above the surface of the water, is the space occupied by the steam. The heat below has been transmitted to the water. The water has boiled, and in its ebullition keeps generating more steam. If the fire be kept brisk, and no passage provided for the steam to escape from, it is clear the steam must be confined or pent up, and more ready to rush out at the first vent. More and more heat is applied below. The water absorbs it, and more and more steam is generated, which steam, from every thing being closed, is very much pent up, and is in the state called high-pressure. Of course, if we still keep adding heat, and generating steam, the pressure within will be too great for the strength of the boiler to stand, and the boiler will burst. Some steam-engines are intended for work with one pressure, and some with another. There are steam-engines which work with 30lb. pressure upon each square inch of the boiler, and those which work with 200 lb. pressure upon each square-inch.

At first it would appear that the high-pressure engine is more dangerous than the low-pressure engine. But such is not found to be the case in practice. In all cases where high-pressure boilers have been attended with danger, there has been the most gross and culpable neglect: under which the same thing would have, and has happened, with low-pressure engines: and in almost every case of sudden explosion the boilers have been made of cast-iron instead of wrought iron: and it may have the effect of removing all fear when we say that some recently-invented boilers,

Digitized by Google

such as Gurney's or Hancock's, are completely free from danger.

When the steam is raised in the boiler B, and ready for use, we open the cock C, and the steam will float up the pipe C, and past G, and press the piston D in such a manner, that D will descend, pushing before it the air or vapour which is below it, and in the cylinder. This air or vapour will be driven along the pipes, and through H F out into the atmosphere J, where it will be dissipated. It will now be seen that the piston D has traversed from the top to the bottom of the cylinder. Now if the handle E (the handle of a cock, F,) be turned into the dotted position, it is clear the cock it acts upon will have a similar movement, and open the communication from G to the atmosphere J; whilst the communication from C F H will be opened from the boiler, to allow the steam to act on the under side of the piston D to press it up again. Thus the piston D will alternately be raised and depressed; and so long as the boiler supplies steam, this alternating motion will be continued: the cock (valve) F being turned at each movement, so as to allow the steam to press on the one side of the piston whilst D allows the steam at the other side to rush off into the atmosphere at J.

But the turning of the cock (or valve) is not a manual operation. The hand is only applied to it when starting or stopping the engine. When the engine is at work, she opens and shuts for herself; a simple piece of mechanism appropriately called a tappit, striking the handle E on the one side or on the other as required. We have not shown this, lest the drawing should be too complicated.

When the piston D is driven from one end to the other like a shuttle-cock, it will be obvious that the piston rod K is driven with it. The rod is connected by an other rod L, which, acting upon the crank M, turns it round, describing the dotted circle in the direction of the arrow. Thus, from the alternating rectilinear motion of the piston, a continuous circular motion is obtained. But it will be seen that when the part marked N reaches in its revolution either of the points O, there will be an uncertainty which way it would turn to go the next circle: it might falter and go back again. In stationary engines a heavy fly-wheel P helps the motion to continue over these centres, as they are called. In steam-carriages, however, the weight of a fly-wheel is so great that it cannot be used to the same boiler; one engine always being in full force when the other is passing the centre—so that there is a continuous and unimpeded motion round the circle.

The power of the engine is calculated by the effect it produces in moving the piston at a given speed, from end to end of the cylinder. Suppose the steam pressed on the side of D next the boiler with a force equal (say) to 50lb. on each square-inch, and the force of the atmosphere, 15lb., is all that opposes the movement of the piston; the difference betwixt the 50lb. pressure of steam and the 15 lb. pressure of the atmosphere, is 35 lb.; and if the area of the whole piston D be 28 square inches, we have a positive pressure of 980 lb, to move the piston D up to the other end. When it arrives at the upper end the cock F is turned, so as to allow the steam to enter at the other (that is the upper) side of the piston D, to drive it back again. We have already shown how the steam below the piston is got rid of; it (at 980 lb. pressure) rushes off into the atmosphere.

The steam blown away requires to be repaid to the boiler in water, which is done by a pump worked by the engine.

R is a safety-valve which is of a certain weight, or having weights on it. Say in the present instance that the area of the valve is one square inch; then the weight on it must be 50 lb. It will easily be seen, that if by neglect or any other cause, too much steam, or too great a pressure of steam, should accumulate in the boiler, this valve will rise, the steam will blow away, nor will it shut again so long as the steam is at a pressure above 50 lb. the square inch, which it is, in this instance, intended to work to. The valve may be so adjusted as to blow open at a single pound pressure, at 300 lb pressure, at any intervening or any higher pressure.

Digitized by Google

## NATURAL PHENOMENA.

### CAUSE OF RAIN.

How many persons there are who have frequent opportunities of witnessing some of the most beautiful phenomenon of nature, and yet are incapable of deriving the slightest mental gratification from the contemplation of them! How many lose some of the highest gratifications man is capable of receiving, for want of knowing how to enjoy them. This is to be regretted, because the man who can

Find tongues in trees—books in the running brooks,
Sermons in stones, and good in every thing,

will be a far happier, and in every respect a far better man, than he who has no such resources of enjoyment. If we look around us, however, we shall find by far the greater number of persons do not understand, and are consequently incapable of enjoying, the pleasure to be derived from observing the harmonious manner in which the laws of nature operate. Ask such persons the cause of the wind blowing, or why the tide ebbs and flows, and how many will be able to answer the question? It appears strange that persons who are constantly witnessing these things should not desire to know the cause of them. but we should remember that, however interesting an object may be when we view it for the first time, yet, if it frequently occurs, we cease to regard it with attention, and at last become quite indifferent about it. To this circumstance we must attribute the general ignorance that exists, even amongst persons of good education, respecting the cause of most of the phenomenon of nature. They are so frequently witnessed, that they are thought very little about. Few persons, however, we think would wish to remain ignorant, when they may easily be instructed; and a few observations, occasionally, upon the subject, will, we trust, prove interesting.

There is one topic of conversation in this country which appears never to lose its interest. Every body can say something upon it, and it generally takes precedence of every thing else—we mean, of course, the weather. In a country like this, where it is subject to such sudden changes, it is rather surprising so many vague and incorrect opinions should exist respecting it. One person considers the influence of the moon the grand power which regulates the state of the weather; another is equally confident that all its changes are occasioned by the wind, and so on. Yet very few can really tell why so apparently-simple a phenomena as rain occurs. The fact is "doctors differ" considerably on this subject, and numberless theories have been propounded to explain it. The most probable we think has been proposed by Dr. Hutton, which may be explained in the following manner:—

If we leave a little water, in an open vessel, exposed to the atmosphere for a few days, we shall find, at the end of that period, that the water has dried up, or, in other words, has evaporated. To explain the cause of this, many reasons have been assigned; but it is unnecessary to enter upon a consideration of them at present. It is sufficient to state that the atmosphere has the power of absorbing, and holding in solution, great quantities of water. It has been calculated that assuming the surface of all the water on the earth to be equal to 130,000,000 geographical miles, that about 60,000 cubic miles of water will be changed into vapour every year. Now, the whole of the water is precipitated to the earth again in the form of rain, and the cause of this, according to Dr. Hutton, will, perhaps, be understood by describing a simple experiment, which every one can perform himself.

Take two beer tumblers, and into one put a little water, just enough to wet the sides, then hold the glass near the fire, till the air in it having become heated has absorbed the water. If the edges of the other tumbler, which has been kept cool, be placed upon the one that has been warmed, the sides of the latter will become covered with moisture. Dr. Hutton explains this as follows:—"According," says he, "to the temperature of the atmosphere so is its power of containing fluids in a state of vapour. A warm atmosphere will absorb a greater quantity of water than a cool atmosphere; and if, therefore, a current of warm air mixes with a current of cold air, a part of the vapour

Digitized by Google

held in solution by the former will be precipitated to the earth in the form of rain: because the temperature of the warm air will be reduced by its mixture with the cold, and its capacity or power of containing vapour be thereby diminished. When, therefore, in the experiment above described, we place the tumbler containing cold air upon that containing warm air, holding water in solution, the temperature of the air is reduced, its power of holding so much water in solution is diminished, and hence the water is precipitated, and forms a moisture on the sides of the glass."

Some philosophers have imagined that rain is the result of an electrical action of the clouds upon each other; and there is very probably some truth in this theory, because we know how suddenly, and with what violence, rain is generally precipitated during a thunder storm. But there can be no doubt but that it is principally to the changes in the temperature of the atmosphere we must attribute the cause of rain.

### THE STEAM ENGINE.

Amongst the numerous and irresistible proofs that improvement is an attribute of human nature, the steam-engine may claim to be considered as one of the most important. The change that has been effected in the manners and social condition of every nation on the face of the earth, by its agency alone, is so astounding, that its history appears to be rather the realization of a tale from the Arabian Night's romances, than an event that has really occurred.

In considering its importance, merely in this country, we must not ask ourselves the question, "What does it do for us?" Our meanest enjoyments result from its influence. Our very existence at the present time, may be said to depend upon it. From our cradles to our graves we are hourly indebted to it. Our swaddling clothes are made of fabrics it has manufactured; and the corn from which our bread is prepared, has been converted into flour by it. Nor are our intellectual wants less dependent upon this mighty power for their gratification. What is not done for us by the printing machine? The people's schoolmaster! What stores of knowledge have been thrown open to the vast multitude by this offspring of the steam-engine! The very paper on which these words are printed could never have been placed in the reader's hands, even for a dozen times the amount it cost him, were it not for the steam-engine. But, besides all this it transports us from place to place with a rapidity that would appear miraculous to our forefathers, could they rise from their graves and see the steam-boat traversing the ocean, regardless alike of wind and tide; or the railway engine drawing after it, with more than giant's strength, long trains of carriages laden with merchandize and passengers. In a word, to the steam-engine we are indebted for nearly every comfort we enjoy. It provides us food—it manufactures our clothes—it even procures the means of warming our habitations—it brings us drugs from foreign countries to relieve us when we are suffering from illness—and it affords us the means of travelling with the greatest ease and pleasure during health—lastly, after "life's fitful fever," it is employed in preparing our very coffins, and will perhaps shortly be the means also of conveying us to our graves!

A description of the wonderful machine that is capable of performing all this, cannot fail of proving interesting to our readers; and we intend, therefore, in our future numbers to give a succinct, yet we hope intelligible history of the steam engine, and of the various improvements which have been made in it, from the time that it was first made available for useful purposes to the present. We intend amply to illustrate the subject with engravings, and have no doubt it will be found highly interesting, as well as instructive.

Before entering, however, upon this subject, it is necessary that the reader should be made somewhat acquainted with the nature and properties of steam; and the present paper will therefore be confined to this subject, and the history of the steam-engine will be commenced in our next.

One of the properties of heat is its

Digitized by Google

power of expanding all bodies into which it enters. Thus a piece of iron made red hot, will be found, on examination, to have increased in bulk; and the same effect takes place in all other bodies, with one or two exceptions, for which no explanation can be given. Now, when water is exposed to the action of heat, it also expands, and assumes a gaseous state, called steam. In this condition it is very elastic, and, like the atmosphere, invisible. The "steam" that is driven out of the spout of a kettle of boiling water is visible enough, it may be said! But this vapour is not steam, properly so called. It is steam condensed into an aqueous vapour by the atmosphere, for steam itself is perfectly invisible.

Water is converted into vapour at nearly all degrees of temperature, but its elasticity at a low temperature is weak, and increases according to the increase of heat. At 212° the elastic power of steam is equal to that of the atmosphere; and at 419° is 1050 times greater; it then exerts a pressure of nearly 15,000 lbs. on every square inch of the inside of the vessel in which it may be confined. It has been found by repeated experience that steam, at the temperature of 210°, occupies about 1800 times the space of the water from which it is formed. But till the commencement of the present century this fact was not generally known. It was thought that the expansion was 14,000 times the volume of water which produced it; this has, however, since been proved erroneous.

Now, if the reader has understood what has just been stated, he will at once perceive that very great power is generated in the formation of steam, and it is in order to regulate and direct this power to useful purposes, that all the complicated, yet beautiful machinery of the steam-engine is employed. We must not omit to mention, while on this part of the subject, that steam can be suddenly condensed, however great may be its state of expansion, into the same quantity of water that it formed before the application of heat had changed its condition; and it was for the purpose of making available the force generated in this manner, that many of the first-invented steam-engines were constructed. It is the expensive force of steam, however, that is the prime mover of the engines of the present day; and thus to the apparently trifling circumstance, of water being converted into an elastic vapour, by the agency of heat, we owe the existence of a power which can "engrave a seal, and crush a mass of obdurate metal like wax before it; draw out, without breaking, a thread as fine as gossamer, and lift a ship-of-war like a bubble in the air; or embroider muslin, forge anchors, cut steel into ribands, and impel itself against the opposition of the very tempest."

### THE AURORA BOREALIS.

On Tuesday evening, the 18th ulto., the inhabitants of the Metropolis had an opportunity of witnessing this beautiful phenomena, which is so seldom to be seen in the country. About eight o'clock "the greatest excitement and anxiety," according to the newspapers, prevailed, in consequence of the sky becoming of a dull red colour, and presenting a similar appearance to what it does during an extensive conflagration. It was accordingly supposed that a very dreadful fire had broken out somewhere very near London, and accordingly the engines of the different establishments were immediately got ready to proceed to any part of the town where the fire might be found to have occurred. A correspondent in the "Times" states, that Mr. Broadwood, the superintendent of the engine establishment in Watling-street, accompanied by eight of his men, proceeded with an engine towards the spot where the destructive element appeared to be raging. On arriving at Clerkenwell Green, where the fire was at first reported to exist, he was joined by the engines from the Whitecross-street, Farringdon-street, and Holborn stations, which were proceeding towards Clerkenwell prison, that building having been stated to be in flames. From that spot the scene of the supposed devastation appearing to be more distantly situate than was at first anticipated, and various localities, such as Islington, Holloway, Highgate, Hornsey, the New Cattle Market, Ball's

Digitized by Google

Pond, &c., having been assigned it, Mr. Broadwood determined on sending engines in each of these directions, whilst he returned to Watling-street to wait authentic intelligence of the precise spot. The engines from the Crown-street, and other more western stations, had, in the mean while, proceeded towards Camden-town, Hampstead, and Finchely, the supposed fire appearing from that part of the town to be in one of those directions; but after scouring the country for miles round, the whole of the engines returned to their respective stations, it having been discovered that the appearance of the sky had been caused by the aurora borealis. It is somewhat singular that in various parts of France similar confusion was created, from its being generally supposed that a great fire had broken out in the different towns where the aurora was visible. It was not seen in Paris, but appeared with great brilliancy at Nantes, Strasburg, and several smaller towns. About November, last year, the aurora was seen in London, but did not then present so fine an appearance.

*(To be continued.)*

## MECHANICS' LIBRARY.

Under this head it is our intention, occasionally, to give a short analysis of good works of natural philosophy, and indeed on any subject with which we think our readers should become acquainted. These reviews will not be confined to books recently published, but those which have been before the public some time, if they are deserving of notice, will also have a place in our "Library." Thus, after a little time, a person desirous of knowing which are the best works to consult on any subject—particularly those connected with science and art, will be able to do so by merely referring to The Mechanic; and another advantage will be, that persons having but little money to expend in the purchase of books, will know how to lay it out to the best advantage.

*Arnott's Elements of Physics.*

We think this is the best book on natural philosophy that has ever been published. The most profound truths are explained in a manner so perspicuous, that we think every one who can read and possess common sense, can understand them. There is no pedantic display of learning, no unnecessary "hard names," in this excellent work. But all the grand laws of nature are explained by simple and familiar illustrations, which no one can misunderstand. How different this to most works on philosophy! The manner in which Dr. Arnott has arranged his subject is peculiarly calculated to impress it on the mind. Each chapter is prefaced with a synopsis of what it contains, and the principle it is intended to illustrate is also clearly stated. Then each chapter is divided into parts, devoted to the explanation of some fact connected with, or dependant on the law stated in the synopsis; and any important word, as "atom," "inertia," "friction," &c., is illustrated by numerous examples, most of them familiar to us in our every-day occupations

The first volume of the Elements of Physics embraces mechanics, pneumatics, hydraulics, acoustics, and the general properties of matter; the second volume treats of the imponderables—light, heat, electricity, magnetism, and the elements of astronomy. Thus a person possessing these volumes has the means of acquiring more correct knowledge than was known to the most eminent philosophers of old.

We much regret that the cost of Dr. Arnott's book prevents those for whom it is so well adapted (the working classes) from obtaining it. The wood-cuts are so numerous that we know the expense of printing must have been very great; but the number of readers has so much increased, even since the publication of the first edition, that we feel confident, if the book was brought out at half its present price, it would meet with more than double the number of purchasers of former editions. Even if it was brought out in weekly or monthly numbers, at its present price, it would be certain amply to repay the cost of publication.

*Painting on Glass.*—A foreigner is said to have discovered, in an old manuscript, the method by which the ancients were enabled to practise this art. It has been so long lost sight of, that its discovery is an event of some importance.

Digitized by Google

## INSTITUTIONS.

A most entertaining and instructive lecture on the History of the Assyrian and Babylonian Monarchy, was delivered at Mr. Lemon's, Palmer House Academy, Islington, by Mr. Chalklen, on Tuesday last. We are sorry our limits will not allow us to enter into a detail of the merits of the speaker in our present Number; we content ourselves therefore by referring to the announcement below.

The Music Class of the London Mechanics' Institution, gave a Concert on Tuesday evening last, which was well attended, and passed off with great eclat. The performance was highly creditable to the class.

A meeting was held on Monday evening at the Southampton Coffee-house, Chancery-lane, for the purpose of forming an association to support Mutual Instruction Societies, &c., with the loan of apparatus and diagrams; to illustrate lectures when required. Rules were adopted, and a Committee appointed. Mr. Lewis, of 17, Edward-street, Hampstead-road, is the Secretary.—*From a Correspondent.*

### LECTURES DURING THE WEEK.

*Western Literary and Scientific Institution*, 47, Leicester-square.—THURSDAY, Nov. 10, at half-past Eight, LECTURE by Mr. Cowper on Engraving and Paper Making.

*London Mechanics' Institution*, Southampton Buildings, Holborn.—FRIDAY, Nov. 4, at half-past Eight, Rev. W. J. Fox, LECTURE on the Study of the Philosophy of the Human Mind.—WEDNESDAY, Nov. 9, Dr. Ritchie, LECTURE on Optics.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge-road.—TUESDAY, Nov. 8, at half-past Eight, Dr. Ritchie, LECTURE on Machinery.

*Islington Literary and Scientific Society.*—Thursday, Nov. 10, at Eight o'clock, Mr. Sheridan Knowles, Lecture on the Drama.

*Eastern Literary and Scientific Institution*, 88, Hackney-road.—Tuesday, Nov. 8, at half-past Eight, T. R. Jones, Esq. on the Structure and Habits of Insects.

*London Institution*, Finsbury Circus.—Monday Nov. 7, at Seven o'clock, W. T. Brande, Esq., on Chemistry.

*Palmer House Academy, Holloway Road.*—Tuesday, Nov. 8, at Seven o'clock, Mr. Chalklen, Lecture on the Sublime in Objects and in Writing.

## MISCELLANIES.

*To revive old Writing.*—Boil gall nuts in wine, then, with a sponge dipped in the liquid, wipe over the lines of the old writing, and all the letters will again appear distinctly visible. This should not be attempted with documents that are required to be preserved, as it has a tendency to destroy the material. But when it is required to decipher any old writing, in order to copy it, the above receipt will be found useful.

*Power of the Windmill.*—A windmill with four sails, measuring seventy feet from the extremity of one sail to that of the opposite one, each being six feet and a half in width, is capable of rising 926 pounds 232 feet in a minute; and of working, on an average, eight hours a day. This is equivalent to the work of thirty-four men; twenty-five square feet of canvas performing the average work of a day labourer. A mill of this magnitude seldom requires the attention of more than two men; and it will thus be seen that, making allowance for its irregularity, wind possesses a decided superiority over every species of animal labour.

*To prevent Burning the Fingers.*—Now that Christmas will soon be here, we dare say most of our young friends will be glad to learn how they may play at "snap dragon" without any fear of burning their fingers. If cherry-tree gum and alum be pounded together, in equal quantities, and the powder mixed with some strong vinegar, which must then be left in a vessel over hot ashes, for about four-and-twenty hours, anything rubbed with this composition, after it has become cold, will not burn.

*Greatest Heat of Water.*—Water, when exposed in an uncovered vessel to the action of heat, can never be raised to a higher temperature than 212°, the boiling point; because, when this degree of heat is attained, steam begins to be given off, and all the additional heat to which the water is exposed, will therefore be engaged in producing steam, and not in increasing the heat of water.

*Horses* v. *Men.*—When private carriages first became common in this country, an act of Parliament was past to prevent the too great adoption of these vehicles, *lest the horses should consume the food of the poor.*

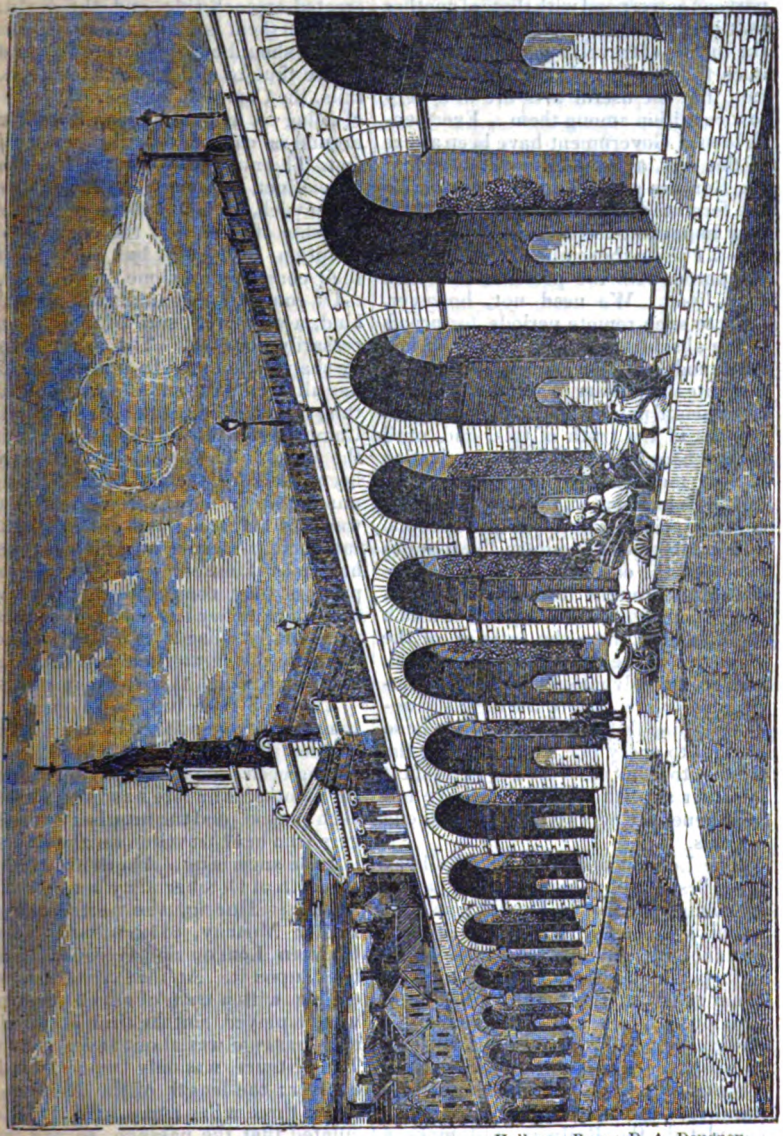
London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,

A MAGAZINE OF ARTS AND SCIENCES.

No. II.] SATURDAY, NOV. 12, 1836. Vol. I.



THE GREENWICH RAILWAY, FROM NEAR THE GRANGE ROAD.

NO. II.—VOL. I.

Holloway Press: D. A. Doudney.

Digitized by Google

### THE GREENWICH RAILWAY.

Of all the applications of the steam engine to purposes of utility, the most important, perhaps, is its employment on rail-roads. The civilization of every country depends so much upon the facility with which the inhabitants of one part can correspond with those of another that it is invariably found, that where the means of travelling are difficult and uncertain, the people are not only ignorant, but the useful arts are in a very low condition among them. Every enlightened Government have been aware of this fact, and the circumstance, that the Romans paid so much attention to the formation of good roads, is a proof how important the subject was considered, even in the semi-barbarous age—compared with the present—in which they lived. We need not, however, refer to such remote periods, for proofs of the absolute necessity for certain and easy modes of conveyance, in order to promote the welfare of a country. Many Continental nations offer melancholy instances of the truth of this, and until their means of internal communication is very much improved, there can be but little hope entertained of the political and social amelioration of the people. The commerce of a country likewise depends on the ease with which the merchandize, brought from foreign parts, can be conveyed from the ports at which it is landed, into the interior of the country, where it will be consumed. Indeed, the advantages which must inevitably follow, where the means of accomplishing this object exist, must be so evident to every one who will take the trouble to think upon the subject, that it is rather suprising rail-roads have not been generally adopted in England long ere this.

The London and Greenwich Railway is the first that has been opened, having its commencement in London; and the remarks we have just made on the importance of railways generally, apply with particular force to this one. It commences on the Southwark side of London Bridge, and proceeds in a straight line, till it arrives at Deptford, to which place it is only finished. Here it sends off a branch, which runs nearly parallel with Deptford Pier; and when completed, the Railway will make a slight bend to the left from this part of the line, and then go on direct to its termination, near Thornton-row, in Greenwich. The Railway is built on arches, formed of brickwork, about 22 feet high, and has two lines of rails for the carriages. A parapet is erected on each side, and the roadway between them is 22 feet wide. If, however, it should be found necessary at any future time to add an additional line of rails, the Company will have the power of doing so, as they have purchased the ground on each side, to the extent of 25 feet. The number of arches which form the viaduct, between London Bridge and Greenwich, is about 1000, and the workmanship of them is of the very best description. 100,000*l.* has been paid for their construction alone.

Of course, for an undertaking of this kind, a very great sum of money is necessarily required. The capital raised by shares amounted to 400,000*l.*, which has all been paid up; and in addition to this, 133,000*l.* has been borrowed by the Company, for the purpose of completing the works. The ground which has not been used for the Railway, although purchased, is, however, valued at upwards of 112.000*l.*; and considering the satisfactory manner in which the work has been finished, we think the proprietors may congratulate themselves that more money has not been required, particularly when it is considered how valuable the greater portion of the land is through which the Railway passes.

The Rail-road has been opened for some time, from a short distance beyond London Bridge to Deptford; the line having been completed thus far for several months. The fare has been sixpence each person, and the number of passengers who have travelled on the Railway is quite surprising, From the 10th to the 26th of October they amounted to 31,707. During the afternoon of Easter Monday, 6312 persons passed between London and Greenwich, and back, upon it. At that time only one engine, with a train of seven carriages, was employed, and the time occupied in each passage was about seven minutes. The distance, was only two miles and a quarter: the length of the Railway is about three miles and a half. It is calculated that the passage, to and from

Digitized by Google

Greenwich, will occupy about ten minutes. The Company are prohibited from taking higher fares than are directed by their Act of Parliament; and the following are the charges determined on, now the Railway is finished:—

By the first class carriages 1s. 0d.
———second ditto 0s. 9d.
———third ditto 0s. 6d.

Persons who reside at Greenwich, or who have frequent occasion to travel on the line, will be allowed to do so on paying a certain sum quarterly. Some individuals have found fault with the Company for not having one fare only, and that sixpence. But the directors will be the best judges of the policy of continuing their present fares; and no doubt, if they find the charge can be reduced, they will do so. At any rate it will be a great saving to persons living at Greenwich, who have occasion to come to town every morning; for besides gaining a great deal of time—about 45 minutes each journey, or nearly 600 hours in the course of a year—an individual who travels by the first-class carriages of the Company, instead of going inside the stage coach, will save upwards of 30*l.* per annum.

It is intended that a train shall leave London for Greenwich every quarter of an hour, and return at the same intervals. Each carriage will hold thirty persons; and from twelve to fourteen carriages can be attached to one engine. On extraordinary occasions, such as Easter or Whitsun Monday, the engine will leave every ten or five minutes, or oftener if necessary. The whole line will be lighted with gas, and the travelling will therefore be as easy by night as by day.

Of the great advantages of this Railway we have not occasion to say much, they must be so very evident. If the sanction of Parliament can be obtained to an act for carrying it on to Gravesend, Chatham, Canterbury, and Dover, a direct communication will be at once opened with the continent. In addition to this, London can then be supplied with fish with much greater expedition than at present; and from the farmers near the line having an opportunity of conveying their stock to London with great facility, of course the prices of the various necessaries of life will be much reduced in the Metropolis. The steam-boats also, which experience so much difficulty in passing up the Pool, particularly at night time, will most probably disembark their passengers at Deptford Pier, and thus many of the accidents that are so frequently occurring, from small boats and barges being run down by steamers in the Pool, will be prevented. In addition to this, many of the inhabitants of London will be able to live a little way out of town: saving in rent, as much as they will expend in paying for their passage, and having the advantage of sleeping in the country.

The Railway has been constructed under the superintendence of George Landmann, Esq., engineer, and by Mr. M'Intosh, the architect; and great praise is certainly due to them for the skilful manner in which it has been completed.

The opening of the line was to have taken place on Tuesday, the 1st of Nov., but in consequence of the iron work of the bridge over Bermondsey-street not having arrived in time, this interesting event is postponed for a few days. When it does take place, we shall have the pleasure of presenting our readers with an exact representation of the entrance of the Railway as it appears on the occasion. The drawing will be taken on the spot by an eminent artist.

## THE HUMAN BODY.

FIRST ARTICLE.

A DISTINGUISHING characteristic of all living beings, is, that the particles of matter of which their bodies are composed, are in a constant state of change. It appears that matter—the term given to every thing appreciable by the senses—can only retain life for a certain definite period; and hence every living thing, animal and vegetable, must, at one time or another, cease to exist: it must die, and the elements of which it is composed, will combine in different proportions to form a part of other animals or plants. It must not be supposed from this, however, that the same matter which forms the organized body while young, will continue a constituent part of it, and alive, until life becomes entirely extinct. Such an opinion would be exceedingly erroneous. A living body

Digitized by Google

does not continue exactly the same for two moments together. A continual change is taking place in it: old particles of matter, that have become unfit for the purposes of life, are being thrown off from the body, and fresh matter is being assimilated to supply their place. The power by which this process is conducted is peculiar to living beings, and distinguishes them from unorganized or dead matter, which has no such power.

We intend to confine our remarks on this subject to the human body, and shall only notice the lower species of animals, as illustrations. We therefore omit all mention of the manner in which the function is performed in animals below man in the scale of existence, and proceed at once to describe some of the more remarkable circumstances connected with the physiology of our own bodies. In doing this we hope to be able to prove to every reader of THE PENNY MECHANIC, with the assistance of wood-cuts, how highly interesting is the study of his own frame, and how essentially necessary it is that every one who wishes to preserve his health, should know something about it.

It has just been said that the particles of which all living beings are composed, are in a continual state of change. This holds true with respect to man as well as with respect to other beings. Our bodies are not the same bodies now, that they were three months ago, or even three hours ago. A great portion has changed its structure; it has become unfit for the purposes of life; is being gradually conveyed out of the system; has been dissipated in the atmosphere, and its place supplied by the food we have partaken of since. A person who has never thought upon the subject will probably be surprised to learn, that he loses between four and six pounds weight, every twenty-four hours, by perspiration alone, and that this takes place in winter, as well as in summer; but such really is the case.

Perspiration is of two kinds—perceptible and imperceptible. The perceptible perspiration is that which bedews the body after strong exercise, and is generally termed sweat; the imperceptible perspiration is so called because we do not pereeive it so palpably as we do in the former. If any one, however, places his hand for a few moments on a looking-glass, he will then be able to observe it, as it will form a slight moisture on the glass. Now, when it is recollected that this perspiration is being constantly given off from the whole surface of the body, night and day, it will not appear so surprising that we lose so much from this cause. Another source of waste is the vapour from the lungs. This, though trifling in quantity each time the breath is expired, or driven out of the chest, amounts to a considerable quantity in the course of twenty-four hours. Messrs. Lavosier and Seguin made a series of very accurate experiments, to determine the exact waste of the body from these two causes. They proceeded as follows:—Having divested themselves of their clothes, they were inclosed in a varnished silk bag, with no opening except a small place to breathe through, and which orifice was glued round the mouth, so that all the perspiration from the body was of course prevented from escaping into the atmosphere. Before entering the silk bag, the experimenters were accurately weighed, and the exact weight of the bag was also ascertained. After they had been inclosed for an hour, they were taken out, and again weighed. It was found they had lost a certain weight, and, in weighing the bag, it was found to have gained not quite as much. After many experiments, it was from this concluded, that the difference between the amount lost by the body, and gained by the bag, must have been given off in vapour from the lungs. Lavosier and Seguin therefore state, that the average loss every twenty-four hours by perspiration from the body, and by the halitus, or vapour from the lungs, is about the quantity just mentioned. At different periods of the year, and even of the day, there is a slight difference, but the above may be considered a fair average.

The loss by insensible perspiration is much greater than by what is commonly termed perspiration, which is only an accumulation of the former. If a person looks closely at his hand,

Digitized by Google

even with the naked eye, he will perceive on the little ridges which run across it, rows of very minute orifices. It is through these that the perspiration is given out, and they are as numerous over the whole surface of the body, as they are on the hand. When the hand is warm, the perspiration oozing from them may be seen to glitter in the sun; and the little black spots, about the size of a pin's head, which frequently show themselves on the chin, and about the face, and which, when pinched, discharge what is frequently believed to be an insect, are nothing more than accumulated perspiration in these little vessels. Another example may be found in the circumstance that some persons have a peculiar odour, particularly when they get warm; this is caused by the imperceptible perspiration. It is the same with many of the lower animals, particularly those which are carnivorous, or feed on flesh. Every one who has visited a collection of wild beasts, must have perceived it. Again, it frequently happens that thin persons require more food than others who are much fatter. This is principally in consequence of the former losing more substance by the means we have been describing. Anxiety and deep thought also generally cause the function to be more active. Shakspeare noticed this fact. In the play of Julius Cæsar, he makes Cæsar say, "Yon Cassius hath a *lean and hungry* look; he *thinks* too much. I would that he were fatter:" and again, "Let me have men about me that *are fat; sleek-headed men*, and such as sleep o' nights."

When perspiration is suddenly checked, indeed, whenever it is stopped at all, it produces one of the most dangerous maladies—because the most neglected—of any to which the people of this country are subjected—we mean a common cold. It is in order to promote perspiration, when persons are suffering from this, that they are recommended to put their feet in warm water, and take "slops." And the only chance spirits-and-water have of curing a cold, is by exciting perspiration. They sometimes do this, but more frequently fail, and make the patient worse than he was before he drank them. We are not, however, going to dilate on any of the "ills that flesh is heir to;" we propose only to give a simple description of the physiology, not of the pathology, of the body, and the reader must excuse us for digressing thus far. It may be mentioned, however, before quitting the subject of perspiration, that the waste of the body, from this cause, is fearfully seen at the commencement of that dreadful disorder, comsumption, when the bed of the unhappy patient is often completely saturated with it. Two-thirds of the people of England are said to die of consumption; and, in every three cases out of four, it is occasioned by a neglected "cold."

Having thus described some of the principal causes which are constantly operating to remove excrementitious matter from the body, and which in the course of from three to four years, change every portion of the human frame, so as to make us entirely different beings; we shall in our next paper commence the subject of digestion—the function by which the food we eat is prepared to supply the place of the matter lost, by the means we have been describing.

### THE VAUXHALL BALLOON.

This balloon has ascended several times merely to gratify the curiosity of the inhabitants of the metropolis; on Monday last it ascended for a more useful purpose, viz., to make an experimental voyage, and, if possible, to cross the Channel, and descend on the continent. Mr. Green had for some time resolved to endeavour to accomplish this object, but the time when the experiment should be made, if it were fixed at all, was kept quite secret. On Monday morning the weather proving favourable, and the wind blowing in the desired direction, it was determined that the ascent should take place that day. Accordingly, at seven o'clock in the morning the inflation of the balloon commenced, and by about one o'clock all was ready for the aeronauts to proceed on their voyage. At twenty-six minutes after one, three gentlemen, Messrs. Green, Monck Mason, and Holland, entered the car, and the bal-

Digitized by Google

loon directly ascended. Very few persons were about the gardens, in consequence of the proceedings not having been made public. The appearance of the balloon as it rose was finer, we think, than on any previous occasion; it appeared quite full of gas, and the colours of the silk were seen to great advantage. Above a ton of ballast was placed in the car, and the balloon may therefore continue up a very long time, by relieving it gradually of this weight. It was not intended, however, to continue any very great length of time in the atmosphere, although the voyagers provided themselves with everything it was thought probable they might require during the time they continued there, such as ham, fowls, brandy, &c., also some cold coffee, to warm which, they took with them a quantity of unslack lime. In order to provide against accidents, in case they could not descend while daylight continued, they had a number of blue-lights with them, which they could ignite, and throw out of the car, and by the light thus obtained, learn the nature of the country the balloon was passing over. Mr. Green and his friends were also provided with passports, and a letter to the King of Belgium from the Embassy in London. It was expected that the balloon would most likely reach the French Coast by about six or seven o'clock; but this is entirely matter of conjecture, as it is impossible to say what currents of air it might meet with which would either facilitate or retard its progress.

Since the above was written, the Mayor of Dover has addressed a letter to the proprietors of Vauxhall Gardens, inclosing one from Mr. Green, which was thrown out of the balloon into Dover, about five o'clock on Monday afternoon. The balloon was then proceeding in a S. E. direction, and at dusk hung out a light from the bottom of the car. The *Morning Chronicle* of Thursday states, that the aeronauts descended at St. Omers, France, at seven o'clock on *Tuesday* evening. This is most probably a misprint for *Monday*, as we do not suppose Mr. Green remained up all night.

---

### FRUITS OF CIVILIZATION.

In England a man of small fortune may cast his looks around him, and say with truth and exultation, "I am lodged in a house that affords me conveniences and comforts which even a king could not command some centuries ago. Ships are crossing the seas in every direction, to bring me what is useful to me from all parts of the earth. In China, men are gathering the tea-leaf for me; in America, they are planting cotton for me; in the West India Islands, they are preparing my sugar and my coffee; in Italy they are feeding silk-worms for me; in Saxony, they are shearing the sheep to make me clothing; at home, powerful steam-engines are spinning and weaving for me, and making cutlery for me, and pumping the mines, that minerals useful to me may be procured. Although my patrimony was small I have post-coaches running day and night, on all the roads to carry my correspondence; I have roads, and canals, and bridges, to bear the coal for my winter fire; nay, I have protecting fleets and armies around my happy country, to secure my enjoyments and repose. Then, I have editors and printers, who daily send me an account of what is going on throughout the world, among all these people who serve me. And in a corner of my house, I have Books! the miracle of all my possessions, more wonderful than the wishing-cap of the Arabian tales; for they transport me instantly, not only to all places, but to all times. By my books, I can conjure up before me, to vivid existence, all the great and good men of antiquity; and for my individual satisfaction, I can make them act over again the most renowned of their exploits: the orators declaim for me: the historians recite: the poets sing: and from the equator to the pole, or from the beginning of time until now, by my books, I can be where I please." This picture is not overcharged, and might be much extended; such being God's goodness and providence, that each individual of the civilized millions that cover the earth, may have nearly the same enjoyments as if he were the single lord of all.—*Dr. Arnott.*

---

Digitized by Google

### THE AURORA BOREALIS.

In our last we noticed the circumstances which attended the appearance of the aurora in the metropolis. We could not then afford room for a description of the phenomenon itself, but, as it is highly interesting, we now add the following particulars:—

In northern countries the aurora borealis is constantly visible during the winter evenings, and is frequently termed, from this circumstance, the northern lights. When they appear in this country it is generally during the spring and autumn, but very rarely with that splendour which distinguishes them when seen near the North Pole. The most remarkable appearance of them in England took place about thirty years ago, of which a very accurate description has been given by Dr. Dalton; and as this will give our readers a very good idea of the phenomena. we quote from it. He says, his attention was first excited by a remarkable red appearance of the clouds, which afforded sufficient light to read by at eight o'clock in the evening, though there was no moon:—

"From half-past nine o'clock till ten P. M., there was a large, luminous, horizontal arch to the southward, almost exactly like those we see in the north; and there was one or more concentric arches northward. It was particularly noticed, that all the arches seemed exactly bisected by the plane of the magnetic meridian. At half-past ten o'clock, streamers appeared very low in the S. E. running to and fro, from W. to E.; they increased in number, and began to approach the zenith, apparently with an accelerated velocity; when, all on a sudden, the whole hemisphere was covered with them, and exhibited such an appearance as surpasses all description. The intensity of the light, the prodigious number and volatility of the beams, the grand intermixture of all the prismatic colours in their utmost splendour, variegating the glowing canopy with the most luxuriant and enchanting scenery, afforded an awful, but at the same time the most pleasing and sublime spectacle in nature. Every one gazed with astonishment; but the uncommon grandeur of the scene only lasted about one minute; the variety of colours disappeared, and the beams lost their lateral motion, and were converted, as usual, into the flashing radiations; but even then it surpassed all other appearances of the aurora, in that the whole hemisphere was covered with it. Notwithstanding the suddenness of the effulgence at the breaking out of the aurora, there was a remarkable regularity in the manner. Apparently, a ball of fire ran along from east to west, and the contrary, with a velocity so great as to be barely distinguishable from one continued train, which kindled up the several rows of beams one after another: these rows were situate befors each other with the exactest order, so that the bases of each row formed a circle crossing the magnetic meridian at right angles; and the several circles rose one above another in such sort, that those near the zenith appeared more distant from each other than those near the horizon, a certain indication that the real distances of the rows were either partly or exactly the same. And it was farther observable, that during the rapid lateral motion of the beams, their direction in every two nearest rows was alternate, so that whilst the motion of the one row was from east to west, that of the next was from west to east."

The cause of the northern lights is unknown. It is supposed, and there are some facts which aparantly support the hypothesis, that they are to be attributed to the passage of electricity through the higher regions of the atmosphere. At present, however, the subject is involved in much obscurity; and from the very few opportunities philosophers have of seeing the aurora, it is extremely difficult to obtain accurate data to reason upon

---

ON THE STUDY OF NATURAL PHILOSOPHY.—There is no occupation which so much strengthens and quickens the judgment as the study of natural philosophy. This praise has usually been bestowed on mathematics; yet a knowledge of abstract mathematics existed with all the absurdities of the dark ages; but a familiarity with natural philosophy, which comprehends mathematics, and gives tangible and pleasing illustrations of the abstract truths, seems incompatible with any

Digitized by Google

gross absurdity. A man whose mental faculties have been sharpened by acquaintance with these exact sciences, in their combination, and who has been engaged, therefore, in contemplating *real relations*, is more likely to discover truth in other questions, and can better defend himself against sophistry of every kind. We cannot have clearer evidence of this, than in the history of the sciences, since the Baconian method of *reasoning by induction* took the place of the visionary *hypothesis* of preceding times.—*Dr. Arnott.*

*How to extinguish a fire in a Chimney.*—So many serious fires have been caused by chimneys catching on fire, and not being quickly extinguished, that the following method of doing this should be made as generally known as possible:—Throw some powdered brimstone on the fire in the grate, or ignite some on the hob, and then put a board or something in front of the fire-place, to prevent the fumes descending into the room. The vapour of the brimstone ascending the chimney, will then effectually extinguish the soot on fire.

*Power of the Steam Engine.*—One of the largest steam-engines yet constructed is that at the United Mine in Cornwall; it can raise 80,000 lbs. 100 feet high per minute; and to effect this enormous labour it only requires about 30 lbs. of coal for the same period of time. A labourer, working ten hours a day, cannot, at most, raise more than 3,750 lbs. *one* foot high per minute. The immense importance of the steam-engine, merely on account of its being able to concentrate its immense power in so small a space as the engine occupies, will at once be evident on comparing the preceding statements.

## INSTITUTIONS.

Botanical Society.—A general meeting of the members of this Society, and others interested in its objects, took place at the Crown and Anchor Tavern, Strand, Nov. 3rd, G. C. Grey, Esq., F. R. S., in the chair. This meeting was well attended, and we are happy to state, that some ladies eminent in botanical science were present, and took great interest in the business of the meeting. Several donations of books, and specimens of plants were announced; new members admitted Fellows of the Society; and an ably-written paper was read by D. Cowper, Esq., author of the *Flora Metropolitana*, on the growth of the common broad bean. The next meeting will be held on the 17th instant.

Zoological Society.—The number of visitors to the Museum of the Society during the last month has been 325, and to the Gardens 8751. The Museum has been removed from Burton-street to Leicester-square.

Meteorological Society.—This Society is about to be revived. A meeting will be held on Tuesday evening, the 15th instant, at 8 o'clock, in the committee-room of the London Mechanics' Institution: Dr. Birkbeck, the President, will take the chair.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday Evening, Nov. 14, at Seven o'clock, W. T. Brande, Esq., on Chemistry. Thursday, at One o'clock afternoon, Mr. Chalklen, on Taste.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Nov. 17, at half-past Eight, Mr. Cowper on Engraving and Paper Making.

*London Mechanics' Institution*, Southampton-buildings, Holborn.—Friday, Nov. 18, at half-past Eight, Rev. W. J. Fox, on the Study of the Philosophy of the Human Mind.—Wednesday, Nov. 16, at half-past Eight, Dr. Ritchie on Optics.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge-road.—Tuesday, Nov. 15, at half-past Eight, Dr. Ritchie on Dynamics.

*Islington Literary and Scientific Society.*—Thursday, Nov. 17, at Eight o'clock, Mr. Elliott, on the Education of the Senses.

*Eastern Literary and Scientific Institution.*—Tuesday, Nov. 15, at half-past Eight, Mr. Hemming, on Chemistry.

*Southwark Literary Society.*—Wednesday, Nov. 16, at half-past Eight, T. R. Jones, Esq., on Natural History.

*Mutual Instruction Society*, 16, Great Tower-street, City.—Monday, Nov. 14, at Eight o'clock, Mr. Neesom—Essay on Predestination.

### TO CORRESPONDENTS.

We are much obliged to "W. F. G. W." for the Acrostic, but we must decline communications of this nature.

"Mr. White," will see we have made use of his Letter. We shall be happy to hear from him.

"A Friend" is perhaps not aware of the difficulty of correcting the press; we receive his observations, however, with thanks.

All communications for the Editor to be left at the Publisher's.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Hollywell-street, Strand; and may be had of all Booksellers

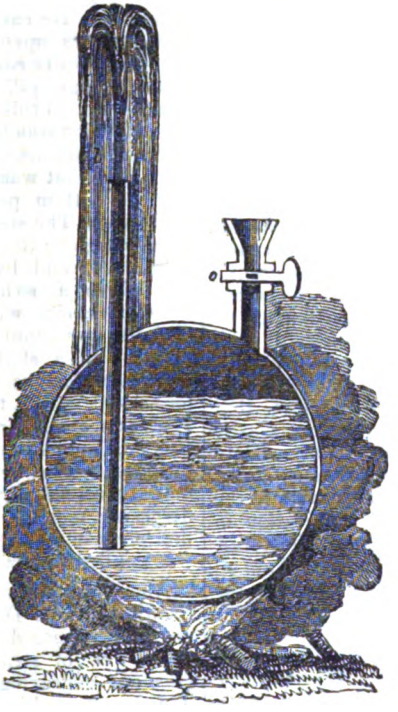
Digitized by Google

# THE PENNY MECHANIC,

A MAGAZINE OF THE ARTS AND SCIENCES.

No. III.] SATURDAY, NOV. 19, 1836. Vol. I.

## DE CAUS'S STEAM ENGINE.



## THE AIR GUN.

FIG.1.

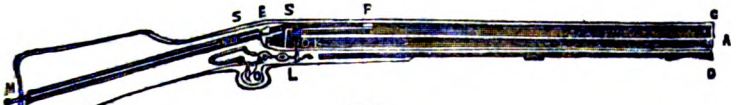
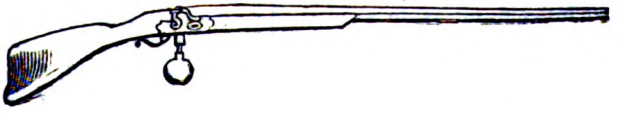



FIG.2





Holloway Press: D. A. Doudney.

Digitized by Google

## THE STEAM ENGINE.

### NO. II.

In tracing the history of the steam-engine, it should be borne in mind that the honour resulting from any invention or discovery is not so justly due to the man who first proposes it, as it is to him who makes a practical application of such invention for the purpose of increasing the enjoyments and the happiness of his fellow-men. In other words, there is far more merit in applying a discovery to purposes of utility, than there is in happening to be the first man to whom the invention may have occurred. There is nothing unjust towards inventors in this mode of reasoning. We are always much obliged to a man for informing us how we may advance ourselves in the world, or increase our prosperity, but we are far more indebted to him who affords us the means of doing so. These remarks apply, we think, particularly to many circumstances connected with the history of the steam-engine. The world is much indebted to the man who first pointed out the fact, that water can be converted into an elastic vapour, and afterwards condensed into water again; but it owes much more to Watt and the other improvers of the steam-engine, for their application of this discovery. We must, however, award to every one his due share of praise for assisting in producing the wonderful machine we are speaking of. Dr. Lardner has very properly remarked that the steam-engine, as it at presents exists, is not the exclusive invention of any one individual; it is a combination of inventions which, for the last two centuries, have been accumulating. When we attempt to trace its history and to determine its first inventor, we experience the same difficulty as is felt in ascertaining the head of a great river: as we ascend its course, it becomes difficult, if not impossible to distinguish it from its tributary streams; and it terminates in a number of threads of water, each in itself so insignificant as to seem unworthy of being called the source of the majestic object which has excited the inquiry. Just so with the steam-engine. The machines that were first invented to act by the power of steam, can no more be compared with the "great mover" of the present day, than can the trickling streams with the mighty river which they assist in forming.

The first person of whom we have any record, who applied the power of steam for the purpose of producing motion, was a Greek philosopher of the name of Hero, who lived about 2,000 years ago. He caused a hollow globe, having tubes opening into the atmosphere, opposite each other, to revolve on two upright pillars, by means of an axis; and into this globe he conveyed steam (which was formed in a cauldron or vase underneath,) through one of the pillars that was made hollow, and had its bottom part inserted in the cauldron. The steam made its escape from the globe through the tubes just mentioned, and by this means gave the globe a swift rotatory motion. This machine, which is termed an Œlipile, was about the year 1590, proposed with a slight alteration, by a German writer, as an excellent means for turning a spit to roast meat upon. It does not appear, however, that it was ever applied even to do so useful a purpose as this, being in fact nothing more than a philosophical toy, and only deserving mention, because it is the first piece of apparatus to which steam was applied as a moving power.

About the beginning of the seventeenth century, De Caus, a French engineer, proposed to employ the elastic power of steam to raise water. (See our engraving in the front page.) This he effected in the following manner. He filled a hollow globe nearly full of water, into which a pipe descended above half-way down, and opened through the top into the atmosphere. He then applied heat to the water, and formed steam, which soon occupied the space between the surface of the water and the top of the globe. As the heat was continued; the expansive force of the steam increased, and, having no way to escape, it pressed on the surface of the water, and forced it up the pipe *b*, which we have stated descended into it some depth. As the water was taken away by this means, more was supplied, through another pipe opening into the boiler, furnished

Digitized by Google

with a stop-cock *o*. This was the earliest application of high-pressure steam with which we are acquainted.

The first person who appears to have applied steam to an useful purpose, was Branca, an Italian. He formed a boiler, which he represented in the shape of a human head and thorax, to which heat was applied, until steam was formed from the water contained in it. The steam was allowed to escape through a tube in the mouth of the figure, and was directed against a wheel, formed with a flat board, or vanes like a windmill. This was driven round by the vapour striking it, and a pinion being attached, motion was by this means given to machinery, which was employed in a pounding mill.

After this period, the properties of steam began to be better known by practical men, and was employed in a variety of ways to raise water in fountains, &c.; but none of them are sufficiently interesting to deserve particular notice in this paper, being little more than specimens of ingenuity misapplied, or unable to produce any useful result.

The next individual whose name is associated with the early history of the steam-engine, is the Marquis of Worcester, a nobleman of the reign of Charles the Second. In 1663 the Marquis published a book which he called "A Century of Inventions," being an account of one hundred discoveries which he claimed as his own. Amongst the rest, he says,—

"I have invented an admirable and forcible way to drive up water by fire, not by drawing or sucking it upwards, for that must be, as the philosopher calleth it, *infra sphæram activitatis*, which is but at such a distance, but this way hath no bounden, if the vessel be strong enough; for I have taken a piece of a whole cannon, whereof the end was burst, and filled it three-quarters full of water, stopping and screwing up the broken end, as also the touch-hole, and making a constant fire under it; within twenty-four hours, it burst and made a great crack; so that, having a way to make my vessels so that they are strengthened by the force within them, and the one to fill after the other, I have seen the water to run like a constant fountain-stream forty feet high. One vessel of water rarified by fire driveth up forty of cold water, and a man that tends the work is but to turn two cocks, that, one vessel of water being consumed, another begins to force and refill with cold water, and so successively, the fire being tended and kept constant, which the self-same person may likewise abundantly perform in the interim between the necessity of turning the said cocks."

This description is supposed by some persons to have given the first idea for the many and great improvements that were afterwards made in the construction of the steam-engine. Other persons, on the contrary, deny that any very great praise is due to the Marquis, because he does not state in what manner the engine is to be constructed; and, as no proof has ever been adduced that he formed one himself, they consider his invention entitled to very little respect. In our next paper on this subject, we shall enter more particularly into the merits of the Marquis's invention.

## THE AIR GUN.

The atmosphere in which we live is an elastic fluid. A portion of it can be compressed, so that it shall not occupy a twentieth of a fortieth part of a space it naturally fills, and yet, on the removal of the pressure by which this condensation has been effected, the air will expand to its original volume. There is a continual tendency in condensed air to do this, and the expansive power or force with which the air endeavours to regain the space it previously occupied, will of course depend upon the degree to which it is condensed. This is the case with all elastic bodies. If we employ a slight force to bend a piece of steel watch-spring, it will have a recoil equal to the power employed in bending it. If we employ a greater force, the result will be the same; and this holds true, not of a watch-spring alone, but of all elastic bodies, and amongst the rest, of the air. It is in order to make available this property of the atmosphere that the air-gun is constructed. The engraving, fig. 1, represents a section of one. It consists of two barrels, one from which the bullets are driven, A, and a large barrel, E, C, D, L, on the

Digitized by Google

outside of it. There is a syringe, S, M, fitted in the stock of the gun, by which the air is injected and condensed in the cavity between the two barrels, through the valve E P. The ball K is put down into its place, in the small barrel, with the ramrod, as in any other gun. At L, is another valve, kept down by a spring seen at F, which valve, being opened by the trigger O, permits the air to come behind the bullet so as to drive it forwards. If this valve be opened and shut suddenly, one charge of condensed air may be sufficient for several discharges of bullets; but if the whole air be discharged on one single bullet, it will drive it out with a greater force. This discharge is effected by means of a lock, placed as in other guns: for the trigger being pulled, the cock will go down and drive the lever O, which will open the valve T, L, and let the air in upon the bullet K.

This gun will perhaps best explain the principle on which air-guns are constructed, although, in the present day, this kind is but seldom used. Great improvement was made in it by Dr. Ellis, by which the air is not condensed in the stock, but in five or six hollow copper balls, about three inches in diameter. These are fitted to a screw on the lock of the gun, and are so furnished with valves as to retain at pleasure the air forced into their cavities, so that they may easily be carried about from place to place, ready charged with condensed air, and the gun itself is rendered as portable as the smallest fowling-piece.

The one most generally in use, however, is that represented by fig. 2. It consists of a common barrel, and under the lock is a round steel tube, having a small moveable pin in the inside, which is pushed out when the trigger is pulled by the spring work within the lock: to this tube a hollow copper ball, charged with condensed air, is screwed on, having a valve opening inwards. It will be seen, therefore, that when the trigger is pulled, the moveable pin in the steel tube is forced suddenly against this valve, thereby opening it, and allowing a portion of the condensed air to escape into the barrel, along which it forces the bullet that has been previously introduced, and thus the gun is discharged. The manner in which the air is condensed we shall take the opportunity of describing more particularly, at some future time, but as several accidents have occurred, in consequence of persons incautiously leaving the copper ball highly charged with condensd air, we think it right to mention, that a portion, at any rate, should always be discharged before laying the gun by. A copper ball may be able to bear the expansive pressure of the air with which it is charged, if the temperature of the ball continue the same, but if it increases—if the ball becomes warmer—of course the atmosphere within it acquires a greater expansive force, which the ball may not be able to withstand. In all cases where a considerable force is required, and consequently a great condensation of air, it will be requisite to have the condensing syringe of a small bore, perhaps not more than half an inch in diameter; otherwise the force requisite to produce the compression will become so great, that the operator cannot work the machine: for as the pressure against every square inch is 15 lbs., and against every circular area of an inch diameter 12 lbs., if the syringe be an inch in diameter, it will require a force of as many times 12 lbs. as the density of the air in the receiver exceeds that of the common atmosphere; so that when the condensation is ten times, the force required will be 120 lbs., whereas, with an half-inch bore, it will only amount to 30 lbs. Besides the air-guns we have described, there are some others, the particulars of which it was not necessary to mention. In the London Encyclopædia, to which we are indepted for part of the materials for this description, the reader will find the subject treated of more fully, and longer descriptions given than we have been able to give.

### HILL'S ROTARY PRINTING MACHINE.

In the "Repertory of Patent Inventions for November, there is a very interesti account of this new machine, from whe we have derived the following particu respecting it:—

The steam printing press was introdu

Digitized by Google

at the close of the year 1814, before which time all printing was done by hand-presses, and the rate at which large sheets, as newspapers, were printed, scarcely ever exceeded 300 single impressions in an hour. The impressions being on one side only of the sheet of paper. The inconvenience this occasioned will perhaps be better understood, when it is mentioned, that the printers of large newspapers, confined in their operations by the slowness of the hand-press, frequently had no resource, under the pressure of urgent demand, but to set up a portion of their matter in duplicate, at an expense of some thousands per annum. When, however, the machine presses were brought into action a great increase of speed was at once obtained. During the twenty-one years which have elapsed since their introduction, various and important improvements have been effected in their construction, and by the rapid and powerful machines now used in printing the daily newspapers, the surprising number of 4000 single impressions is sometimes given off in an hour. The inventor of the machine which is the subject of this paper, believes that he has effected improvements by which the rate of printing just named, great as it is, may be still further increased, and that in no trifling degree. His machine being worked by two men, can be made to throw off sheets of the size of the evening newspapers, at the rate of 7000 or 8000 perfect copies per hour. In order to explain the means by which this advantage is proposed to be obtained, it is necessary to notice shortly the construction of the machines now commonly in use. The type necessary to the printing of one side of the sheet, consisting (for a newspaper) of about 100,000 separate pieces, are collected, and being arranged in proper columns, the mass is placed in an iron frame called a chase, which binds it firmly together, and the *form* (as the chase filled with type is technically called) is then transferred to the machine, where it is secured upon a strong iron plate, which plate being mounted upon truck wheels, forms a carriage; and there is a small rail-road for it t[illegible]on. When the machine is in [illegible]rriage, with the form upon [illegible]face of the type constitutes [illegible], is constantly moved [illegible]ward horizontally, and it comes in contact, first, [illegible]para[illegible] consists [illegible]l rol-[illegible]on-the friction of the surface of the type acting upon their lower sides as it runs under them. Next the *form*, being now inked, passes under a large revolving iron cylinder about the form and size of an ordinary double drum; this lies horizontally, and its curved surface is covered by a closely-wove blanket bound tightly upon it. The paper as it is supplied to the machine, is made partly to encircle this cylinder, being held against it by tapes which move with the cylinder. The surface of the type moving horizontally, and the surface of the blanket-covered cylinder revolving with the paper upon it, having exactly the same speed, and as the type passes under the cylinder, the side of the cylinder which bears the paper is brought undermost, and presses the paper upon the type, whereby it is printed. The cylinder then rises a little, the types return under it without contact, and passes back to the inking rollers for another supply of ink, preparatory to the printing of another sheet; while the printed sheet, if the machine be constructed to hold one form only, now passes out from between the cylinder and the tapes, and is received by an attendant.

Simple and ingenious as this arrangement undoubtedly is, the experienced machinist will at once perceive that much time is lost in consequence of the motion of the *form* (which, with its carriage, weighs from 5 cwt. to a ton,) having constantly to be changed; first to obtain a supply of ink for the type, and then to regain the position proper for printing the succeeding list. These defects appear to be unavoidable while the type forms a flat surface, as it is not practicable to make a flat surface move continuously.

Mr. Hill proposes to obviate these defects by affixing the type around a cylinder, so that the surface of the type itself shall form a kind of outer cylinder, the whole resembling slightly an organ barrel with its projecting pins; and he has certainly overcome the principal difficulty as it appears, viz., the discovery of a mode of readily and securely attaching the pieces of type to the cylinder, and this without making it difficult to detach them for the purpose of correction, revisal, &c. According to his plan each piece of type is slightly wedge-like in its form, so that when several are laid side by side, they form a segment or arch, whose lower curve corresponds to the surface of the cylinder upon which the type is to be fixed, and each piece, instead of the ordinary narrow notches in its side, made for the compositors' convenience, has a very broad

Digitized by Google

outside of it. There is a syringe, S, M, fitted in the stock of the gun, by which the air is injected and condensed in the cavity between the two barrels, through the valve E P. The ball K is put down into its place, in the small barrel, with the ramrod, as in any other gun. At L, is another valve, kept down by a spring seen at P, which valve, being opened by the trigger O, permits the air to come behind the bullet so as to drive it forwards. If this valve be opened and shut suddenly, one charge of condensed air may be sufficient for several discharges of bullets; but if the whole air be discharged on one single bullet, it will drive it out with a greater force. This discharge is effected by means of a lock, placed as in other guns: for the trigger being pulled, the cock will go down and drive the lever O, which will open the valve T, L, and let the air in upon the bullet K.

This gun will perhaps best explain the principle on which air-guns are constructed, although, in the present day, this kind is but seldom used. Great improvement was made in it by Dr. Ellis, by which the air is not condensed in the stock, but in five or six hollow copper balls, about three inches in diameter. These are fitted to a screw on the lock of the gun, and are so furnished with valves as to retain at pleasure the air forced into their cavities, so that they may easily be carried about from place to place, ready charged with condensed air, and the gun itself is rendered as portable as the smallest fowling-piece.

The one most generally in use, however, is that represented by fig. 2. It consists of a common barrel, and under the lock is a round steel tube, having a small moveable pin in the inside, which is pushed out when the trigger is pulled by the spring work within the lock: to this tube a hollow copper ball, charged with condensed air, is screwed on, having a valve opening inwards. It will be seen, therefore, that when the trigger is pulled, the moveable pin in the steel tube is forced suddenly against this valve, thereby opening it, and allowing a portion of the condensed air to escape into the barrel, along which it forces the bullet that has been previously introduced, and thus the gun is discharged. The manner in which the air is condensed we shall take the opportunity of describing more particularly, at some future time, but as several accidents have occurred, in consequence of persons incautiously leaving the copper ball highly charged with condensd air, we think it right to mention, that a portion, at any rate, should always be discharged before laying the gun by. A copper ball may be able to bear the expansive pressure of the air with which it is charged, if the temperature of the ball continue the same, but if it increases—if the ball becomes warmer—of course the atmosphere within it acquires a greater expansive force, which the ball may not be able to withstand. In all cases where a considerable force is required, and consequently a great condensation of air, it will be requisite to have the condensing syringe of a small bore, perhaps not more than half an inch in diameter; otherwise the force requisite to produce the compression will become so great, that the operator cannot work the machine: for as the pressure against every square inch is 15 lbs., and against every circular area of an inch diameter 12 lbs., if the syringe be an inch in diameter, it will require a force of as many times 12 lbs. as the density of the air in the receiver exceeds that of the common atmosphere; so that when the condensation is ten times, the force required will be 120 lbs., whereas, with an half-inch bore, it will only amount to 30 lbs. Besides the air-guns we have described, there are some others, the particulars of which it was not necessary to mention. In the London Encyclopædia, to which we are indepted for part of the materials for this description, the reader will find the subject treated of more fully, and longer descriptions given than we have been able to give.

### HILL'S ROTARY PRINTING MACHINE.

In the "Repertory of Patent Inventions," for November, there is a very interesting account of this new machine, from whence we have derived the following particulars respecting it:—

The steam printing press was introduced

Digitized by Google

at the close of the year 1814, before which time all printing was done by hand-presses, and the rate at which large sheets, as newspapers, were printed, scarcely ever exceeded 300 single impressions in an hour. The impressions being on one side only of the sheet of paper. The inconvenience this occasioned will perhaps be better understood, when it is mentioned, that the printers of large newspapers, confined in their operations by the slowness of the hand-press, frequently had no resource, under the pressure of urgent demand, but to set up a portion of their matter in duplicate, at an expense of some thousands per annum. When, however, the machine presses were brought into action a great increase of speed was at once obtained. During the twenty-one years which have elapsed since their introduction, various and important improvements have been effected in their construction, and by the rapid and powerful machines now used in printing the daily newspapers, the surprising number of 4000 single impressions is sometimes given off in an hour. The inventor of the machine which is the subject of this paper, believes that he has effected improvements by which the rate of printing just named, great as it is, may be still further increased, and that in no trifling degree. His machine being worked by two men, can be made to throw off sheets of the size of the evening newspapers, at the rate of 7000 or 8000 perfect copies per hour. In order to explain the means by which this advantage is proposed to be obtained, it is necessary to notice shortly the construction of the machines now commonly in use. The type necessary to the printing of one side of the sheet, consisting (for a newspaper) of about 100,000 separate pieces, are collected, and being arranged in proper columns, the mass is placed in an iron frame called a chase, which binds it firmly together, and the *form* (as the chase filled with type is technically called) is then transferred to the machine, where it is secured upon a strong iron plate, which plate being mounted upon truck wheels, forms a carriage; and there is a small rail-road for it to run upon. When the machine is in action, this carriage, with the form upon it, of which the face of the type constitutes the upper surface, is constantly moved backward and forward horizontally, and as it passes along, it comes in contact, first, with the inking apparatus, which consists principally of a number of cylindrical rollers covered with ink, and laying horizontally, and which are set in motion by the friction of the surface of the type acting upon their lower sides as it runs under them. Next the *form*, being now inked, passes under a large revolving iron cylinder about the form and size of an ordinary double drum; this lies horizontally, and its curved surface is covered by a closely-wove blanket bound tightly upon it. The paper as it is supplied to the machine, is made partly to encircle this cylinder, being held against it by tapes which move with the cylinder. The surface of the type moving horizontally, and the surface of the blanket-covered cylinder revolving with the paper upon it, having exactly the same speed, and as the type passes under the cylinder, the side of the cylinder which bears the paper is brought undermost, and presses the paper upon the type, whereby it is printed. The cylinder then rises a little, the types return under it without contact, and passes back to the inking rollers for another supply of ink, preparatory to the printing of another sheet; while the printed sheet, if the machine be constructed to hold one form only, now passes out from between the cylinder and the tapes, and is received by an attendant.

Simple and ingenious as this arrangement undoubtedly is, the experienced machinist will at once perceive that much time is lost in consequence of the motion of the *form* (which, with its carriage, weighs from 5 cwt. to a ton,) having constantly to be changed; first to obtain a supply of ink for the type, and then to regain the position proper for printing the succeeding list. These defects appear to be unavoidable while the type forms a flat surface, as it is not practicable to make a flat surface move continuously.

Mr. Hill proposes to obviate these defects by affixing the type around a cylinder, so that the surface of the type itself shall form a kind of outer cylinder, the whole resembling slightly an organ barrel with its projecting pins; and he has certainly overcome the principal difficulty as it appears, viz., the discovery of a mode of readily and securely attaching the pieces of type to the cylinder, and this without making it difficult to detach them for the purpose of correction, revisal, &c. According to his plan each piece of type is slightly wedge-like in its form, so that when several are laid side by side, they form a segment or arch, whose lower curve corresponds to the surface of the cylinder upon which the type is to be fixed, and each piece, instead of the ordinary narrow notches in its side, made for the compositors' convenience, has a very broad

Digitized by Google

notch ; when the type is placed together to form a line, these broad notches in the several pieces range together, and form an arched chase capable of receiving a thin brass plate of corresponding form and dimensions, which, when applied, is wholly embedded in the chase. When a line of type, with its plate, or scaleboard, so embedded within its substance, is compressed between the lines, and its plate thereby completely inclosed and kept in its place, it is manifested that no single piece of type can be displaced ; if any move the whole line must move. Means have been adopted which we have not space to describe, by which these plates are made to take their place in the course of the composition, with the utmost readiness and certainty. The lines of the type are placed in a kind of tray or galley, of the length and breadth of a newspaper column ; the bottom of which tray is a portion of a cylinder, the curvature being in its breadth, not in its length, somewhat as though a stave were taken from a truly cylindrical cask, and used as the bottom of a tray, the curved side being uppermost. The lines of type are secured in the tray principally by horizontal screw pressure acting against the ends of the column of type ; but as a precaution against a tendency to bulge, which sometimes occurs in a column of the great length required in a newspaper, a few of the embedded plates have small projecting tenons at their ends, which lock into certain chases in the sides of the tray just described. The type so fixed upon a cylinder together with the proper space for margin, occupying the whole circumference ; the cylinder thus clothed is placed in contact with a blanket-covered cylinder of the same dimensions, and the two are connected by toothed wheels, and the paper is passed between them with moderate compression, just as a piece of metal is passed between the rolls of a flatting mill. An inking apparatus is attached, by which a constant supply of ink is communicated to the type as it revolves. As the type cylinder has affixed to it precisely the quantity of type requisite for printing a sheet on one side ; and as there is no vacant space upon the cylinder except for the margins, it follows that at each revolution of the cylinder exactly one sheet will be printed ; and that the instant the printing of one sheet is completed, that of another will be commenced ; no loss of time therefore can occur if the supply of ink and paper can be kept up. To supply the machine with paper in single sheets, at the rate of two per second at which rate the machine has hitherto been worked, would be difficult if not impracticable ; the plan therefore has been to make use of a long scroll of paper as it is produced by the ordinary paper machines, the end of which being introduced between the rollers of the machine then supplies itself by unwinding the scroll from a reel. It is intended to cut the scroll up into single sheet by additional macuinery, as it passes from the printing rollers.

## ATMOS THE GIANT,
### AND HIS RELATIONS.

Atmos the Giant is one of the last of that formidable race which, in old time, are said to have infested the earth, and about whom the youthful mind is so edified on the perusal of the "Arabian Nights,' Persian Tales, &c. &c., in the present day. His pedigree is extremely ancient, since his father and mother, who are both living, were coeval with the creation. Atmos is their only son, and was probably born in Paradise, at the time when a thick mist covered the surface of the earth at the command of God for the purpose of irrigation. Many, many centuries however elapsed between this event and the discovery of those useful qualities which so eminently distinguished him, and which are now so universally known ; and long did he in vain strive to call the attention of man to his ability and willingness to serve him. (Often as our forefathers nested in the chimney corner would his childish treble be heard when the kettle became sufficiently acquainted with the fire, like the chirp of the cricket, or the high-fetched tones of the highland bagpipes ; and he himself would soon after be seen issuiug from the spout like a true genii in the form of a cloud of smoke. When, however, his praiseworthy efforts were unheeded (which they invariably were), he would manifest his impatience by a rattling noise, shaking whatever covered the water to which the spell which bound him had brought him. His anger was not unfrequently displayed by biting the hands and arms of thoughtless people, especially cooks, with whom he was particularly indignant, because, by the force of the spell, they often compelled the noble individual of the Atmos family to boil potatoes. At length, however, after trials and disappointments innumerable, a man was found, who, by attending to his peculiarities, and especially by observiug rigo-

* It will, perhaps, be interesting to our young readers to know that Atmos is the Greek word for vapour, otherwise steam.

Digitized by Google

rously the conditions of the spell, applied the great irresistible power to more useful, and, at the same time, to more honourable uses. Having therefore succeeded thus far, Atmos appeared in dreams and visions of the night to those to whom this knowledge (for it was soon spread) was imparted, and told them, that if they would observe certain conditions he and his relations would always be ready to assist them; that they would heave up mountains, split rocks into atoms, spin wool and cotton as fine as gossamer, print books and impel ships against all opposing powers, provided they would constantly feed his old father whose powers of digestions were such that he could live upon coals. These offers were accordingly listened to, and in proportion to the employment which these reflecting men gave to Atmos, the conditions to the spell were better understood.

*(To be continued.)*

## DIVISION OF LABOUR.

THE science of Political Economy treats of the production and diffusion of wealth, and has no concern with moral results, excepting so far as these may be connected with an improvement, in the means of obtaining the necessaries and luxuries of life. The object of the Political Economist therefore is simply to ascertain how the greatest amount of wealth may be produced from a given quantity of labour; and it is in this point of view alone that the division of employment can be said to be beneficial. A man, by confining himself to one simple operation in any branch of science, will undoubtedly become more expert in it and be able to accomplish more work, than if he had to attend to several. There can be no denying this, but at the same time that a man does so, the more does he approach to the character of a mere machine, and the greater necessity there consequently is that his leisure time should be employed in cultivating his mind, in order to counteract the pernicious tendency of his occupation.

In Wade's History of the Middle and Working Classes, some interesting instances of the division of labour are given; from amongst them we take the following:

"A workman in the daily practice of one simple business, acquires a dexterity and dispatch which would not be possible were he more variously occupied. Not only is the play of the muscles improved, but each sense and faculty, by concentration of object. A banker's clerk will count out a bundle of notes with ten times the rapidity of another person not used to the employment. Mr. Babbage mentions a clerk of the Bank of England who, upon an emergency, signed his name, consisting of eleven letters, to 5300 notes, during eleven working-hours, and he also arranged the notes he had signed in parcels of fifty each. This affords some idea how the power of execution is increased by the practice of an employment, and its effects on production, especially in piece-work, must be very great. In nail-making, Adam Smith states, a boy brought up to the trade will make upwards of 1300 nails in a day, whilst a common smith, who, though accustomed to handle the hammer, has never been used to make nails, would not be able to make above two or three hundred in a day, and 'these, too, very bad ones.'

"To make 5546 pins, weighing one pound, occupies four men, four woman, and two children rather more than seven hours and a half of time, and the total expense of labour, each being paid according to his skill and the time he is employed, amounts to nearly 1*s.* 1*d.* The ratio of the wages earned per day by the persons so employed, varies from 4½*d.*, the sum paid to the boy who assists in twisting and cutting the heads, to 6*s.*, the sum paid to the man who finishes the most difficult part of the art. Of the seven hours and a half consumed, four are taken up by a woman in heading; rather more than two hours by another woman in preparing, and the remaining hour and a half is spent by the other eight persons in drawing the wire, straightening the wire, pointing and tining. Now it is obvious that if only one person was employed to make a pin, from the beginning to the end, he must not only have the skill and strength to execute the more easy and simple processes, but those more difficult and laborious. It follows that one half of his time would be spent in putting on the heads—a part of the work only worth 1*s.* 3*d.* a day; while his skill, if better employed, would in the same time produce five times as much. Pins in consequence would be nearly four times the currant price; and the reason of their cheapness is a skilful division of labour, an apportionment of the several processes in the trade among men, women, and children, according to the force and ability requisite to the performance of each.

"Watchmaking is another striking illustration of the principle that the division of labour is limited by the extent of

Digitized by Google

the market, or, in other words, the demand for its products. From the inquiries of a parlimentary committee, it appears there are one hundred aud two distinct branches in this trade, each having its separate class of workmen: and that, with the exception of the watch-finishers, whose business is to put together the several parts of a watch, not one of the classes can work at any other than his own particular employment. Now it is plain, if the demand for watches were not at least sufficient to occupy one hundred and two persons, this minute division of occupation could not be supported, and watches would neither be so cheap nor so well executed. The same cause is in operation in almost every department of trade and business: they are all consolidated or divided according as the market is more or less extensive. In a village or small town, for instance, it is common to find the business of a draper, grocer, cheesemonger, and poulterer, all carried on in one establishment, the demand not being extensive enough to maintain a shopkeeper in each line of business. Again, there are some sorts of industry that can be carried on nowhere but in a great city. A porter, shoeblack, or hackney-coachman, can find employment and subsistence in no other place. A vilage, or ordinary market-town, would be too narrow a sphere to offord them constant occupation.

## MECHANICS' LIBRARY.

*A New English Grammar*, by George King.—Darton and Son.

It is a feature of the age in which we live, that knowledge of all kinds in now eagerly sought after; and even grammar is not thought too dry a study, by young persons who wish, or are obliged to educate themselves. This is evident from the number of works on this subject that are constantly issuing from the press. Amongst those, we have seen few better calculated to assist the learner, or prove useful in the school-room, than the one before us by Mr. King. The different parts of speech are familiarly explained, and the illustrations can easily be understood. He has also added a few general rules in orthography, which will prove exceedingly useful to most persons: altogether it is a very useful little book.

QUERE.—What is the cause of the rise of sap in trees, and is it to be accounted for on the principle of capillary attraction?

*A curious Patent.*—Amongst the patents lately expired, there is one by a perukemaker, which is thus curiously described in the specification: "For a Forensic Wig, the cures whereof are constructed on a principle to supersede the necessity of frizzing, curling, or using hard pomatum, and for forming curls in *a way not to be uncurled*; and also for the *tails* of the wigs, not to require tying in dressing; and further, the *impossibility of any person untying them*,"—Think of any one untying the tail of a judge's or barrister's wig!

## INSTITUTIONS.

*London Mechanics' Institution.*—The fourteenth anniversary meeting will be held on Friday, the 2nd of December next, on the plan of a *conversationi*. The author of "The Mechanics' Saturday Night," Will read a portion of a manuscript poem he has lately written, and several other gentlemen will address the meeting. Drawings, models, &c., executed by members will also be exhibited. Persons having any they may wish to have introduced to the notice of the meeting, must send them to the Institution, on or before the 26th instant.

*Dr. Ritchie's Lectures* on Optics, we intended to have noticed singly, but upon consideration, think it will be better to give a report of them, when the course is finished.

LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus—Monday at seven o'clock, W. T. Brande, Esq., on Chemistry.—Thursday, at one o'clock afternoon, W. Chalklen, Esq., on Taste.

*London Mechanics Institution*, Southampton-buildings, Chancery lane.—Wednesday, Dr. Ritchie, on Optics—Friday, Dr. Birkbeck, on Meteorology; both at half-past eight o clock.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, at half-past eight o'clock, W. Chalklen, Esq., on History.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge road.—Tuesday, W. C. Dendy, Esq., at half-past eight o'clock, on Ghost Seeing.

*Islington Literary and Scientific Society.*—Thursday, at eight o'clock, Mr. Gilbert, on the Commerce of Ancient Greece.

*Eastern Literary and Scientific Institution*, 88, Hackney-road,—Tuesday, Mr. Elliott, on the Education of the Senses.

*Mutual Instruction Society*, Great Tower-street.—Monday, at eight o,clock, Mr. Chatterly, on Botany.

## TO CORRESPONDENTS.

We are much obliged to our *revising* "Friend" for his suggestions last week. His "*Hue-and-Cry*" ought to be rewarded with a "*Fool's Cap*"

We shall be happy to hear from "C.' again.

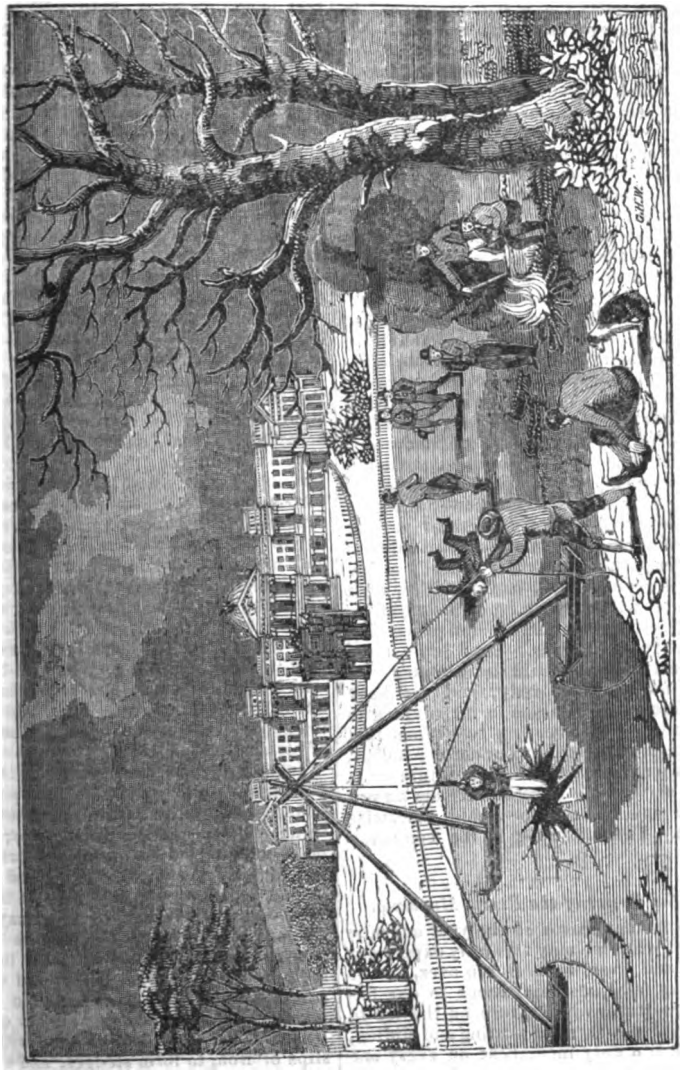
London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Hollywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC.

## A MAGAZINE OF ARTS AND SCIENCES.

No. IV.] SATURDAY, NOV. 26, 1836. [Vol. I.



APPARATUS FOR RESCUING DROWNING PERSONS FROM THE ICE.

VOL. I.—NO. IV.

Holloway Press: D. A. Doudney.

Digitized by Google

loon directly ascended. Very few persons were about the gardens, in consequence of the proceedings not having been made public. The appearance of the balloon as it rose was finer, we think, than on any previous occasion; it appeared quite full of gas, and the colours of the silk were seen to great advantage. Above a ton of ballast was placed in the car, and the balloon may therefore continue up a very long time, by relieving it gradually of this weight. It was not intended, however, to continue any very great length of time in the atmosphere, although the voyagers provided themselves with everything it was thought probable they might require during the time they continued there, such as ham, fowls, brandy, &c., also some cold coffee, to warm which, they took with them a quantity of unslack lime. In order to provide against accidents, in case they could not descend while daylight continued, they had a number of blue-lights with them, which they could ignite, and throw out of the car, and by the light thus obtained, learn the nature of the country the balloon was passing over. Mr. Green and his friends were also provided with passports, and a letter to the King of Belgium from the Embassy in London. It was expected that the balloon would most likely reach the French Coast by about six or seven o'clock; but this is entirely matter of conjecture, as it is impossible to say what currents of air it might meet with which would either facilitate or retard its progress.

Since the above was written, the Mayor of Dover has addressed a letter to the proprietors of Vauxhall Gardens, inclosing one from Mr. Green, which was thrown out of the balloon into Dover, about five o'clock on Monday afternoon. The balloon was then proceeding in a S. E. direction, and at dusk hung out a light from the bottom of the car. The *Morning Chronicle* of Thursday states, that the aeronauts descended at St. Omers, France, at seven o'clock on *Tuesday* evening. This is most probably a misprint for *Monday*, as we do not suppose Mr. Green remained up all night.

---

## FRUITS OF CIVILIZATION.

In England a man of small fortune may cast his looks around him, and say with truth and exultation, "I am lodged in a house that affords me conveniences and comforts which even a king could not command some centuries ago. Ships are crossing the seas in every direction, to bring me what is useful to me from all parts of the earth. In China, men are gathering the tea-leaf for me; in America, they are planting cotton for me; in the West India Islands, they are preparing my sugar and my coffee; in Italy they are feeding silk-worms for me; in Saxony, they are shearing the sheep to make me clothing; at home, powerful steam-engines are spinning and weaving for me, and making cutlery for me, and pumping the mines, that minerals useful to me may be procured. Although my patrimony was small I have post-coaches running day and night, on all the roads to carry my correspondence; I have roads, and canals, and bridges, to bear the coal for my winter fire; nay, I have protecting fleets and armies around my happy country, to secure my enjoyments and repose. Then, I have editors and printers, who daily send me an account of what is going on throughout the world, among all these people who serve me. And in a corner of my house, I have Books! the miracle of all my possessions, more wonderful than the wishing-cap of the Arabian tales; for they transport me instantly, not only to all places, but to all times. By my books, I can conjure up before me, to vivid existence, all the great and good men of antiquity; and for my individual satisfaction, I can make them act over again the most renowned of their exploits: the orators declaim for me: the historians recite: the poets sing: and from the equator to the pole, or from the beginning of time until now, by my books, I can be where I please." This picture is not overcharged, and might be much extended; such being God's goodness and providence, that each individual of the civilized millions that cover the earth, may have nearly the same enjoyments as if he were the single lord of all.—*Dr. Arnott.*

---

Digitized by Google

### THE AURORA BOREALIS.

In our last we noticed the circumstances which attended the appearance of the aurora in the metropolis. We could not then afford room for a description of the phenomenon itself, but, as it is highly interesting, we now add the following particulars:—

In northern countries the aurora borealis is constantly visible during the winter evenings, and is frequently termed, from this circumstance, the northern lights. When they appear in this country it is generally during the spring and autumn, but very rarely with that splendour which distinguishes them when seen near the North Pole. The most remarkable appearance of them in England took place about thirty years ago, of which a very accurate description has been given by Dr. Dalton; and as this will give our readers a very good idea of the phenomena. we quote from it. He says, his attention was first excited by a remarkable red appearance of the clouds, which afforded sufficient light to read by at eight o'clock in the evening, though there was no moon:—

"From half-past nine o'clock till ten P. M., there was a large, luminous, horizontal arch to the southward, almost exactly like those we see in the north; and there was one or more concentric arches northward. It was particularly noticed, that all the arches seemed exactly bisected by the plane of the magnetic meridian. At half-past ten o'clock, streamers appeared very low in the S. E. running to and fro, from W. to E.; they increased in number, and began to approach the zenith, apparently with an accelerated velocity; when, all on a sudden, the whole hemisphere was covered with them, and exhibited such an appearance as surpasses all description. The intensity of the light, the prodigious number and volatility of the beams, the grand intermixture of all the prismatic colours in their utmost splendour, variegating the glowing canopy with the most luxuriant and enchanting scenery, afforded an awful, but at the same time the most pleasing and sublime spectacle in nature. Every one gazed with astonishment; but the uncommon grandeur of the scene only lasted about one minute; the variety of colours disappeared, and the beams lost their lateral motion, and were converted, as usual, into the flashing radiations; but even then it surpassed all other appearances of the aurora, in that the whole hemisphere was covered with it. Notwithstanding the suddenness of the effulgence at the breaking out of the aurora, there was a remarkable regularity in the manner. Apparently, a ball of fire ran along from east to west, and the contrary, with a velocity so great as to be barely distinguishable from one continued train, which kindled up the several rows of beams one after another: these rows were situate befors each other with the exactest order, so that the bases of each row formed a circle crossing the magnetic meridian at right angles; and the several circles rose one above another in such sort, that those near the zenith appeared more distant from each other than those near the horizon, a certain indication that the real distances of the rows were either partly or exactly the same. And it was farther observable, that during the rapid lateral motion of the beams, their direction in every two nearest rows was alternate, so that whilst the motion of the one row was from east to west, that of the next was from west to east."

The cause of the northern lights is unknown. It is supposed, and there are some facts which aparantly support the hypothesis, that they are to be attributed to the passage of electricity through the higher regions of the atmosphere. At present, however, the subject is involved in much obscurity; and from the very few opportunities philosophers have of seeing the aurora, it is extremely difficult to obtain accurate data to reason upon

---

On the Study of Natural Philosophy.—There is no occupation which so much strengthens and quickens the judgment as the study of natural philosophy. This praise has usually been bestowed on mathematics; yet a knowledge of abstract mathematics existed with all the absurdities of the dark ages; but a familiarity with natural philosophy, which comprehends mathematics, and gives tangible and pleasing illustrations of the abstract truths, seems incompatible with any

Digitized by Google

gross absurdity. A man whose mental faculties have been sharpened by acquaintance with these exact sciences, in their combination, and who has been engaged, therefore, in contemplating *real relations*, is more likely to discover truth in other questions, and can better defend himself against sophistry of every kind. We cannot have clearer evidence of this, than in the history of the sciences, since the Baconian method of *reasoning by induction* took the place of the visionary *hypothesis* of preceding times.—*Dr. Arnott.*

*How to extinguish a fire in a Chimney.*—So many serious fires have been caused by chimneys catching on fire, and not being quickly extinguished, that the following method of doing this should be made as generally known as possible:—Throw some powdered brimstone on the fire in the grate, or ignite some on the hob, and then put a board or something in front of the fire-place, to prevent the fumes descending into the room. The vapour of the brimstone ascending the chimney, will then effectually extinguish the soot on fire.

*Power of the Steam Engine.*—One of the largest steam-engines yet constructed is that at the United Mine in Cornwall; it can raise 80,000 lbs. 100 feet high per minute; and to effect this enormous labour it only requires about 30 lbs. of coal for the same period of time. A labourer, working ten hours a day, cannot, at most, raise more than 3,750 lbs. *one* foot high per minute. The immense importance of the steam-engine, merely on account of its being able to concentrate its immense power in so small a space as the engine occupies, will at once be evident on comparing the preceding statements.

## INSTITUTIONS.

Botanical Society.—A general meeting of the members of this Society, and others interested in its objects, took place at the Crown and Anchor Tavern, Strand, Nov. 3rd, G. C. Grey, Esq., F. R. S., in the chair. This meeting was well attended, and we are happy to state, that some ladies eminent in botanical science were present, and took great interest in the business of the meeting. Several donations of books, and specimens of plants were announced; new members admitted Fellows of the Society; and an ably-written paper was read by D. Cowper, Esq., author of the *Flora Metropolitana*, on the growth of the common broad bean. The next meeting will be held on the 17th instant.

Zoological Society.—The number of visitors to the Museum of the Society during the last month has been 325, and to the Gardens 8751. The Museum has been removed from Burton-street to Leicester-square.

Meteorological Society.—This Society is about to be revived. A meeting will be held on Tuesday evening, the 15th instant, at 8 o'clock, in the committee-room of the London Mechanics' Institution: Dr. Birkbeck, the President, will take the chair.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday Evening, Nov. 14, at Seven o'clock, W. T. Brande, Esq., on Chemistry. Thursday, at One o'clock afternoon, Mr. Chalklen, on Taste.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Nov. 17, at half-past Eight, Mr. Cowper on Engraving and Paper Making.

*London Mechanics' Institution*, Southampton-buildings, Holborn.—Friday, Nov. 18, at half-past Eight, Rev. W. J. Fox, on the Study of the Philosophy of the Human Mind.—Wednesday, Nov. 16, at half-past Eight, Dr. Ritchie on Optics.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge-road.—Tuesday, Nov. 15, at half-past Eight, Dr. Ritchie on Dynamics.

*Islington Literary and Scientific Society.*—Thursday, Nov. 17, at Eight o'clock, Mr. Elliott, on the Education of the Senses.

*Eastern Literary and Scientific Institution.*—Tuesday, Nov. 15, at half-past Eight, Mr. Hemming, on Chemistry.

*Southwark Literary Society.*—Wednesday, Nov. 16, at half-past Eight, T. R. Jones, Esq., on Natural History.

*Mutual Instruction Society*, 16, Great Tower-street, City.—Monday, Nov. 14, at Eight o'clock, Mr. Neesom—Essay on Predestination.

### TO CORRESPONDENTS.

We are much obliged to "W. F. G. W." for the Acrostic, but we must decline communications of this nature.

"Mr. White," will see we have made use of his Letter. We shall be happy to hear from him.

"A Friend" is perhaps not aware of the difficulty of correcting the press; we receive his observations, however, with thanks.

All communications for the Editor to be left at the Publisher's.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Hollywell-street, Strand; and may be had of all Booksellers.

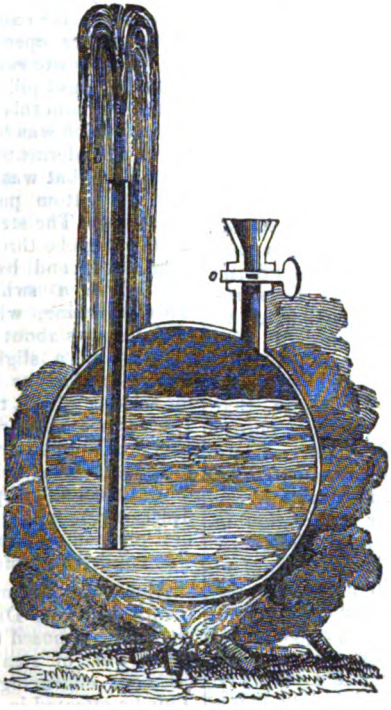
Digitized by Google

# THE PENNY MECHANIC,

A MAGAZINE OF THE ARTS AND SCIENCES.

No. III.] SATURDAY, NOV. 19, 1836. Vol. I.

## DE CAUS'S STEAM ENGINE.



## THE AIR GUN.

FIG.1.

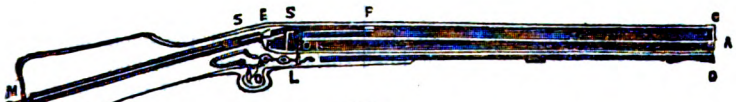



FIG.2

Holloway Press: D. A. Doudney.

Digitized by Google

## THE STEAM ENGINE.

### NO. II.

In tracing the history of the steam-engine, it should be borne in mind that the honour resulting from any invention or discovery is not so justly due to the man who first proposes it, as it is to him who makes a practical application of such invention for the purpose of increasing the enjoyments and the happiness of his fellow-men. In other words, there is far more merit in applying a discovery to purposes of utility, than there is in happening to be the first man to whom the invention may have occurred. There is nothing unjust towards inventors in this mode of reasoning. We are always much obliged to a man for informing us how we may advance ourselves in the world, or increase our prosperity, but we are far more indebted to him who affords us the means of doing so. These remarks apply, we think, particularly to many circumstances connected with the history of the steam-engine. The world is much indebted to the man who first pointed out the fact, that water can be converted into an elastic vapour, and afterwards condensed into water again; but it owes much more to Watt and the other improvers of the steam-engine, for their application of this discovery. We must, however, award to every one his due share of praise for assisting in producing the wonderful machine we are speaking of. Dr. Lardner has very properly remarked that the steam-engine, as it at presents exists, is not the exclusive invention of any one individual; it is a combination of inventions which, for the last two centuries, have been accumulating. When we attempt to trace its history and to determine its first inventor, we experience the same difficulty as is felt in ascertaining the head of a great river: as we ascend its course, it becomes difficult, if not impossible to distinguish it from its tributary streams; and it terminates in a number of threads of water, each in itself so insignificant as to seem unworthy of being called the source of the majestic object which has excited the inquiry. Just so with the steam-engine. The machines that were first invented to act by the power of steam, can no more be compared with the "great mover" of the present day, than can the trickling streams with the mighty river which they assist in forming.

The first person of whom we have any record, who applied the power of steam for the purpose of producing motion, was a Greek philosopher of the name of Hero, who lived about 2,000 years ago. He caused a hollow globe, having tubes opening into the atmosphere, opposite each other, to revolve on two upright pillars, by means of an axis; and into this globe he conveyed steam (which was formed in a cauldron or vase underneath,) through one of the pillars that was made hollow, and had its bottom part inserted in the cauldron. The steam made its escape from the globe through the tubes just mentioned, and by this means gave the globe a swift rotatory motion. This machine, which is termed an Œlipile, was about the year 1590, proposed with a slight alteration, by a German writer, as an excellent means for turning a spit to roast meat upon. It does not appear, however, that it was ever applied even to do so useful a purpose as this, being in fact nothing more than a philosophical toy, and only deserving mention, because it is the first piece of apparatus to which steam was applied as a moving power.

About the beginning of the seventeenth century, De Caus, a French engineer, proposed to employ the elastic power of steam to raise water. (See our engraving in the front page.) This he effected in the following manner. He filled a hollow globe nearly full of water, into which a pipe descended above half-way down, and opened through the top into the atmosphere. He then applied heat to the water, and formed steam, which soon occupied the space between the surface of the water and the top of the globe. As the heat was continued; the expansive force of the steam increased, and, having no way to escape, it pressed on the surface of the water, and forced it up the pipe *b*, which we have stated descended into it some depth. As the water was taken away by this means, more was supplied, through another pipe opening into the boiler, furnished

Digitized by Google

with a stop-cock *o*. This was the earliest application of high-pressure steam with which we are acquainted.

The first person who appears to have applied steam to an useful purpose, was Branca, an Italian. He formed a boiler, which he represented in the shape of a human head and thorax, to which heat was applied, until steam was formed from the water contained in it. The steam was allowed to escape through a tube in the mouth of the figure, and was directed against a wheel, formed with a flat board, or vanes like a windmill. This was driven round by the vapour striking it, and a pinion being attached, motion was by this means given to machinery, which was employed in a pounding mill.

After this period, the properties of steam began to be better known by practical men, and was employed in a variety of ways to raise water in fountains, &c.; but none of them are sufficiently interesting to deserve particular notice in this paper, being little more than specimens of ingenuity misapplied, or unable to produce any useful result.

The next individual whose name is associated with the early history of the steam-engine, is the Marquis of Worcester, a nobleman of the reign of Charles the Second. In 1663 the Marquis published a book which he called "A Century of Inventions," being an account of one hundred discoveries which he claimed as his own. Amongst the rest, he says,—

"I have invented an admirable and forcible way to drive up water by fire, not by drawing or sucking it upwards, for that must be, as the philosopher calleth it, *infra sphæram activitatis*, which is but at such a distance, but this way hath no bounden, if the vessel be strong enough; for I have taken a piece of a whole cannon, whereof the end was burst, and filled it three-quarters full of water, stopping and screwing up the broken end, as also the touch-hole, and making a constant fire under it; within twenty-four hours, it burst and made a great crack; so that, having a way to make my vessels so that they are strengthened by the force within them, and the one to fill after the other, I have seen the water to run like a constant fountain-stream forty feet high. One vessel of water rarified by fire driveth up forty of cold water, and a man that tends the work is but to turn two cocks, that, one vessel of water being consumed, another begins to force and refill with cold water, and so successively, the fire being tended and kept constant, which the self-same person may likewise abundantly perform in the interim between the necessity of turning the said cocks."

This description is supposed by some persons to have given the first idea for the many and great improvements that were afterwards made in the construction of the steam-engine. Other persons, on the contrary, deny that any very great praise is due to the Marquis, because he does not state in what manner the engine is to be constructed; and, as no proof has ever been adduced that he formed one himself, they consider his invention entitled to very little respect. In our next paper on this subject, we shall enter more particularly into the merits of the Marquis's invention.

## THE AIR GUN.

The atmosphere in which we live is an elastic fluid. A portion of it can be compressed, so that it shall not occupy a twentieth of a fortieth part of a space it naturally fills, and yet, on the removal of the pressure by which this condensation has been effected, the air will expand to its original volume. There is a continual tendency in condensed air to do this, and the expansive power or force with which the air endeavours to regain the space it previously occupied, will of course depend upon the degree to which it is condensed. This is the case with all elastic bodies. If we employ a slight force to bend a piece of steel watch-spring, it will have a recoil equal to the power employed in bending it. If we employ a greater force, the result will be the same; and this holds true, not of a watch-spring alone, but of all elastic bodies, and amongst the rest, of the air. It is in order to make available this property of the atmosphere that the air-gun is constructed. The engraving, fig. 1, represents a section of one. It consists of two barrels, one from which the bullets are driven, A, and a large barrel, E, C, D, L, on the

Digitized by Google

outside of it. There is a syringe, S, M, fitted in the stock of the gun, by which the air is injected and condensed in the cavity between the two barrels, through the valve E P. The ball K is put down into its place, in the small barrel, with the ramrod, as in any other gun. At L, is another valve, kept down by a spring seen at F, which valve, being opened by the trigger O, permits the air to come behind the bullet so as to drive it forwards. If this valve be opened and shut suddenly, one charge of condensed air may be sufficient for several discharges of bullets; but if the whole air be discharged on one single bullet, it will drive it out with a greater force. This discharge is effected by means of a lock, placed as in other guns: for the trigger being pulled, the cock will go down and drive the lever O, which will open the valve T, L, and let the air in upon the bullet K.

This gun will perhaps best explain the principle on which air-guns are constructed, although, in the present day, this kind is but seldom used. Great improvement was made in it by Dr. Ellis, by which the air is not condensed in the stock, but in five or six hollow copper balls, about three inches in diameter. These are fitted to a screw on the lock of the gun, and are so furnished with valves as to retain at pleasure the air forced into their cavities, so that they may easily be carried about from place to place, ready charged with condensed air, and the gun itself is rendered as portable as the smallest fowling-piece.

The one most generally in use, however, is that represented by fig. 2. It consists of a common barrel, and under the lock is a round steel tube, having a small moveable pin in the inside, which is pushed out when the trigger is pulled by the spring work within the lock: to this tube a hollow copper ball, charged with condensed air, is screwed on, having a valve opening inwards. It will be seen, therefore, that when the trigger is pulled, the moveable pin in the steel tube is forced suddenly against this valve, thereby opening it, and allowing a portion of the condensed air to escape into the barrel, along which it forces the bullet that has been previously introduced, and thus the gun is discharged. The manner in which the air is condensed we shall take the opportunity of describing more particularly, at some future time, but as several accidents have occurred, in consequence of persons incautiously leaving the copper ball highly charged with condensd air, we think it right to mention, that a portion, at any rate, should always be discharged before laying the gun by. A copper ball may be able to bear the expansive pressure of the air with which it is charged, if the temperature of the ball continue the same, but if it increases—if the ball becomes warmer—of course the atmosphere within it acquires a greater expansive force, which the ball may not be able to withstand. In all cases where a considerable force is required, and consequently a great condensation of air, it will be requisite to have the condensing syringe of a small bore, perhaps not more than half an inch in diameter; otherwise the force requisite to produce the compression will become so great, that the operator cannot work the machine: for as the pressure against every square inch is 15 lbs., and against every circular area of an inch diameter 12 lbs., if the syringe be an inch in diameter, it will require a force of as many times 12 lbs. as the density of the air in the receiver exceeds that of the common atmosphere; so that when the condensation is ten times, the force required will be 120 lbs., whereas, with an half-inch bore, it will only amount to 30 lbs. Besides the air-guns we have described, there are some others, the particulars of which it was not necessary to mention. In the London Encyclopædia, to which we are indepted for part of the materials for this description, the reader will find the subject treated of more fully, and longer descriptions given than we have been able to give.

## HILL'S ROTARY PRINTING MACHINE.

In the "Repertory of Patent Inventions," for November, there is a very interesting account of this new machine, from whence we have derived the following particulars respecting it:—

The steam printing press was introduced

Digitized by Google

at the close of the year 1814, before which time all printing was done by hand-presses, and the rate at which large sheets, as newspapers, were printed, scarcely ever exceeded 300 single impressions in an hour. The impressions being on one side only of the sheet of paper. The inconvenience this occasioned will perhaps be better understood, when it is mentioned, that the printers of large newspapers, confined in their operations by the slowness of the hand-press, frequently had no resource, under the pressure of urgent demand, but to set up a portion of their matter in duplicate, at an expense of some thousands per annum. When, however, the machine presses were brought into action a great increase of speed was at once obtained. During the twenty-one years which have elapsed since their introduction, various and important improvements have been effected in their construction, and by the rapid and powerful machines now used in printing the daily newspapers, the surprising number of 4000 single impressions is sometimes given off in an hour. The inventor of the machine which is the subject of this paper, believes that he has effected improvements by which the rate of printing just named, great as it is, may be still further increased, and that in no trifling degree. His machine being worked by two men, can be made to throw off sheets of the size of the evening newspapers, at the rate of 7000 or 8000 perfect copies per hour. In order to explain the means by which this advantage is proposed to be obtained, it is necessary to notice shortly the construction of the machines now commonly in use. The type necessary to the printing of one side of the sheet, consisting (for a newspaper) of about 100,000 separate pieces, are collected, and being arranged in proper columns, the mass is placed in an iron frame called a chase, which binds it firmly together, and the *form* (as the chase filled with type is technically called) is then transferred to the machine, where it is secured upon a strong iron plate, which plate being mounted upon truck wheels, forms a carriage; and there is a small rail-road for it to run upon. When the machine is in action, this carriage, with the form upon it, of which the face of the type constitutes the upper surface, is constantly moved backward and forward horizontally, and as it passes along, it comes in contact, first, with the inking apparatus, which consists principally of a number of cylindrical rollers covered with ink, and laying horizontally, and which are set in motion by the friction of the surface of the type acting upon their lower sides as it runs under them. Next the *form*, being now inked, passes under a large revolving iron cylinder about the form and size of an ordinary double drum; this lies horizontally, and its curved surface is covered by a closely-wove blanket bound tightly upon it. The paper as it is supplied to the machine, is made partly to encircle this cylinder, being held against it by tapes which move with the cylinder. The surface of the type moving horizontally, and the surface of the blanket-covered cylinder revolving with the paper upon it, having exactly the same speed, and as the type passes under the cylinder, the side of the cylinder which bears the paper is brought undermost, and presses the paper upon the type, whereby it is printed. The cylinder then rises a little, the types return under it without contact, and passes back to the inking rollers for another supply of ink, preparatory to the printing of another sheet; while the printed sheet, if the machine be constructed to hold one form only, now passes out from between the cylinder and the tapes, and is received by an attendant.

Simple and ingenious as this arrangement undoubtedly is, the experienced machinist will at once perceive that much time is lost in consequence of the motion of the *form* (which, with its carriage, weighs from 5 cwt. to a ton,) having constantly to be changed; first to obtain a supply of ink for the type, and then to regain the position proper for printing the succeeding list. These defects appear to be unavoidable while the type forms a flat surface, as it is not practicable to make a flat surface move continuously.

Mr. Hill proposes to obviate these defects by affixing the type around a cylinder, so that the surface of the type itself shall form a kind of outer cylinder, the whole resembling slightly an organ barrel with its projecting pins; and he has certainly overcome the principal difficulty as it appears, viz., the discovery of a mode of readily and securely attaching the pieces of type to the cylinder, and this without making it difficult to detach them for the purpose of correction, revisal, &c. According to his plan each piece of type is slightly wedge-like in its form, so that when several are laid side by side, they form a segment or arch, whose lower curve corresponds to the surface of the cylinder upon which the type is to be fixed, and each piece, instead of the ordinary narrow notches in its side, made for the compositors' convenience, has a very broad

Digitized by Google

notch; when the type is placed together to form a line, these broad notches in the several pieces range together, and form an arched chase capable of receiving a thin brass plate of corresponding form and dimensions, which, when applied, is wholly embedded in the chase. When a line of type, with its plate, or scaleboard, so embedded within its substance, is compressed between the lines, and its plate thereby completely inclosed and kept in its place, it is manifested that no single piece of type can be displaced; if any move the whole line must move. Means have been adopted which we have not space to describe, by which these plates are made to take their place in the course of the composition, with the utmost readiness and certainty. The lines of the type are placed in a kind of tray or galley, of the length and breadth of a newspaper column; the bottom of which tray is a portion of a cylinder, the curvature being in its breadth, not in its length, somewhat as though a stave were taken from a truly cylindrical cask, and used as the bottom of a tray, the curved side being uppermost. The lines of type are secured in the tray principally by horizontal screw pressure acting against the ends of the column of type; but as a precaution against a tendency to bulge, which sometimes occurs in a column of the great length required in a newspaper, a few of the embedded plates have small projecting tenons at their ends, which lock into certain chases in the sides of the tray just described. The type so fixed upon a cylinder together with the proper space for margin, occupying the whole circumference; the cylinder thus clothed is placed in contact with a blanket-covered cylinder of the same dimensions, and the two are connected by toothed wheels, and the paper is passed between them with moderate compression, just as a piece of metal is passed between the rolls of a flatting mill. An inking apparatus is attached, by which a constant supply of ink is communicated to the type as it revolves. As the type cylinder has affixed to it precisely the quantity of type requisite for printing a sheet on one side; and as there is no vacant space upon the cylinder except for the margins, it follows that at each revolution of the cylinder exactly one sheet will be printed; and that the instant the printing of one sheet is completed, that of another will be commenced; no loss of time therefore can occur if the supply of ink and paper can be kept up. To supply the machine with paper in single sheets, at the rate of two per second at which rate the machine has hitherto been worked, would be difficult if not impracticable; the plan therefore has been to make use of a long scroll of paper as it is produced by the ordinary paper machines, the end of which being introduced between the rollers of the machine then supplies itself by unwinding the scroll from a reel. It is intended to cut the scroll up into single sheet by additional macuinery, as it passes from the printing rollers.

## ATMOS THE GIANT,

### AND HIS RELATIONS.

Atmos the Giant is one of the last of that formidable race which, in old time, are said to have infested the earth, and about whom the youthful mind is so edified on the perusal of the "Arabian Nights," Persian Tales, &c. &c., in the present day. His pedigree is extremely ancient, since his father and mother, who are both living, were coeval with the creation. Atmos is their only son, and was probably born in Paradise, at the time when a thick mist covered the surface of the earth at the command of God for the purpose of irrigation. Many, many centuries however elapsed between this event and the discovery of those useful qualities which so eminently distinguished him, and which are now so universally known; and long did he in vain strive to call the attention of man to his ability and willingness to serve him. (Often as our forefathers nested in the chimney corner would his childish treble be heard when the kettle became sufficiently acquainted with the fire, like the chirp of the cricket, or the high-fetched tones of the highland bagpipes; and he himself would soon after be seen issuing from the spout like a true genii in the form of a cloud of smoke. When, however, his praiseworthy efforts were unheeded (which they invariably were), he would manifest his impatience by a rattling noise, shaking whatever covered the water to which the spell which bound him had brought him. His anger was not unfrequently displayed by biting the hands and arms of thoughtless people, especially cooks, with whom he was particularly indignant, because, by the force of the spell, they often compelled the noble individual of the Atmos family to boil potatoes. At length, however, after trials and disappointments innumerable, a man was found, who, by attending to his peculiarities, and especially by observiug rigo-

* It will, perhaps, be interesting to our young readers to know that Atmos is the Greek word for vapour, otherwise steam.

Digitized by Google

rously the conditions of the spell, applied the great irresistible power to more useful, and, at the same time, to more honourable uses. Having therefore succeeded thus far, Atmos appeared in dreams and visions of the night to those to whom this knowledge (for it was soon spread) was imparted, and told them, that if they would observe certain conditions he and his relations would always be ready to assist them; that they would heave up mountains, split rocks into atoms, spin wool and cotton as fine as gossamer, print books and impel ships against all opposing powers, provided they would constantly feed his old father whose powers of digestions were such that he could live upon coals. These offers were accordingly listened to, and in proportion to the employment which these reflecting men gave to Atmos, the conditions to the spell were better understood.

*(To be continued.)*

## DIVISION OF LABOUR.

The science of Political Economy treats of the production and diffusion of wealth, and has no concern with moral results, excepting so far as these may be connected with an improvement, in the means of obtaining the necessaries and luxuries of life. The object of the Political Economist therefore is simply to ascertain how the greatest amount of wealth may be produced from a given quantity of labour; and it is in this point of view alone that the division of employment can be said to be beneficial. A man, by confining himself to one simple operation in any branch of science, will undoubtedly become more expert in it and be able to accomplish more work, than if he had to attend to several. There can be no denying this, but at the same time that a man does so, the more does he approach to the character of a mere machine, and the greater necessity there consequently is that his leisure time should be employed in cultivating his mind, in order to counteract the pernicious tendency of his occupation.

In Wade's History of the Middle and Working Classes, some interesting instances of the division of labour are given; from amongst them we take the following:

"A workman in the daily practice of one simple business, acquires a dexterity and dispatch which would not be possible were he more variously occupied. Not only is the play of the muscles improved, but each sense and faculty, by concentration of object. A banker's clerk will count out a bundle of notes with ten times the rapidity of another person not used to the employment. Mr. Babbage mentions a clerk of the Bank of England who, upon an emergency, signed his name, consisting of eleven letters, to 5300 notes, during eleven working-hours, and he also arranged the notes he had signed in parcels of fifty each. This affords some idea how the power of execution is increased by the practice of an employment, and its effects on production, especially in piece-work, must be very great. In nail-making, Adam Smith states, a boy brought up to the trade will make upwards of 1300 nails in a day, whilst a common smith, who, though accustomed to handle the hammer, has never been used to make nails, would not be able to make above two or three hundred in a day, and 'these, too, very bad ones.'

"To make 5546 pins, weighing one pound, occupies four men, four woman, and two children rather more than seven hours and a half of time, and the total expense of labour, each being paid according to his skill and the time he is employed, amounts to nearly 1*s.* 1*d.* The ratio of the wages earned per day by the persons so employed, varies from 4½*d.*, the sum paid to the boy who assists in twisting and cutting the heads, to 6*s.*, the sum paid to the man who finishes the most difficult part of the art. Of the seven hours and a half consumed, four are taken up by a woman in heading; rather more than two hours by another woman in preparing, and the remaining hour and a half is spent by the other eight persons in drawing the wire, straightening the wire, pointing and tining. Now it is obvious that if only one person was employed to make a pin, from the beginning to the end, he must not only have the skill and strength to execute the more easy and simple processes, but those more difficult and laborious. It follows that one half of his time would be spent in putting on the heads—a part of the work only worth 1*s.* 3*d.* a day; while his skill, if better employed, would in the same time produce five times as much. Pins in consequence would be nearly four times the currant price; and the reason of their cheapness is a skilful division of labour, an apportionment of the several processes in the trade among men, women, and children, according to the force and ability requisite to the performance of each.

"Watchmaking is another striking illustration of the principle that the division of labour is limited by the extent of

Digitized by Google

the market, or, in other words, the demand for its products. From the inquiries of a parliamentary committee, it appears there are one hundred and two distinct branches in this trade, each having its separate class of workmen: and that, with the exception of the watch-finishers, whose business is to put together the several parts of a watch, not one of the classes can work at any other than his own particular employment. Now it is plain, if the demand for watches were not at least sufficient to occupy one hundred and two persons, this minute division of occupation could not be supported, and watches would neither be so cheap nor so well executed. The same cause is in operation in almost every department of trade and business: they are all consolidated or divided according as the market is more or less extensive. In a village or small town, for instance, it is common to find the business of a draper, grocer, cheesemonger, and poulterer, all carried on in one establishment, the demand not being extensive enough to maintain a shopkeeper in each line of business. Again, there are some sorts of industry that can be carried on nowhere but in a great city. A porter, shoeblack, or hackney-coachman, can find employment and subsistence in no other place. A vilage, or ordinary market-town, would be too narrow a sphere to offord them constant occupation.

## MECHANICS' LIBRARY.

*A New English Grammar*, by George King.—Darton and Son.

It is a feature of the age in which we live, that knowledge of all kinds in now eagerly sought after; and even grammar is not thought too dry a study, by young persons who wish, or are obliged to educate themselves. This is evident from the number of works on this subject that are constantly issuing from the press. Amongst those, we have seen few better calculated to assist the learner, or prove useful in the school-room, than the one before us by Mr. King. The different parts of speech are familiarly explained, and the illustrations can easily be understood. He has also added a few general rules in orthography, which will prove exceedingly useful to most persons: altogether it is a very useful little book.

QUERE.—What is the cause of the rise of sap in trees, and is it to be accounted for on the principle of capillary attraction?

*A curious Patent.*—Amongst the patents lately expired, there is one by a perukemaker, which is thus curiously described in the specification: "For a Forensic Wig, the cures whereof are constructed on a principle to supersede the necessity of frizzing, curling, or using hard pomatum, and for forming curls in *a way not to be uncurled*; and also for the *tails* of the wigs, not to require tying in dressing; and further, the *impossibility of any person untying them*,"—Think of any one untying the tail of a judge's or barrister's wig!

## INSTITUTIONS.

*London Mechanics' Institution.*—The fourteenth anniversary meeting will be held on Friday, the 2nd of December next, on the plan of a *conversationi*. The author of "The Mechanics' Saturday Night," Will read a portion of a manuscript poem he has lately written, and several other gentlemen will address the meeting. Drawings, models, &c., executed by members will also be exhibited. Persons having any they may wish to have introduced to the notice of the meeting, must send them to the Institution, on or before the 26th instant.

*Dr. Ritchie's Lectures* on Optics, we intended to have noticed singly, but upon consideration, think it will be better to give a report of them, when the course is finished.

LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus—Monday at seven o'clock, W. T. Brande, Esq., on Chemistry.—Thursday. at one o'clock afternoon, W. Chalklen, Esq., on Taste.

*London Mechanics Institution*, Southampton-buildings, Chancery lane.—Wednesday, Dr. Ritchie, on Optics—Friday, Dr. Birkbeck, on Meteorology; both at half-past eight o'clock.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, at half-past eight o'clock, W. Chalklen, Esq., on History.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge road.—Tuesday, W. C. Dendy, Esq., at half-past eight o'clock, on Ghost Seeing.

*Islington Literary and Scientific Society.*—Thursday, at eight o'clock, Mr. Gilbert, on the Commerce of Ancient Greece.

*Eastern Literary and Scientific Institution*, 88, Hackney-road,—Tuesday, Mr. Elliott, on the Education of the Senses.

*Mutual Instruction Society*, Great Tower-street.—Monday, at eight o,clock, Mr. Chatterly, on Botany.

## TO CORRESPONDENTS.

We are much obliged to our *revising* "Friend" for his suggestions last week. His "*Hue-and-Cry*" ought to be rewarded with a "*Fool's Cap*" We shall be happy to hear from "C.' again.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Hollywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. IV.] SATURDAY, NOV. 26, 1836. [Vol. I.

APPARATUS FOR RESCUING DROWNING PERSONS FROM THE ICE.

VOL. I.—NO. IV.

Holloway Press: D. A. Doudney.

Digitized by Google

## ACCIDENTS ON THE ICE.

If the man who makes two blades of grass grow where only one grew before, is a benefactor to his species, certainly he who points out the means by which the life of even a single individual can be preserved, is entitled to no slight degree of praise. We have much pleasure in applying these remarks to a communication we have received from a correspondent, in which he describes two methods, that we think will be found practicable, for preventing many of those distressing accidents which so frequently occur, from the sudden breaking in of the ice, while persons are enjoying the delightful recreation of skating. In the Metropolis, where the opportunity for enjoying this amusement so seldom occurs, those who are fond of it too often venture on the ice before it is in a fit state to bear them; the consequence is, that every winter, when there has been a tolerably sharp frost for a few days, the newspapers have to record the fatal effects of the temerity of thoughtless young men, who have sacrificed their lives through their indiscretion. It unfortunately happens, too, that not unfrequently those who exert themselves most actively to rescue the persons who are drowning, are themselves exposed to great danger, and sometimes meet with the same death they were endeavouring to preserve others from. This is in consequence of the very ill-constructed apparatus that at present exists for rendering assistance in cases of emergency of this kind. Indeed, a few poles, a rope or two, and a ladder, or a piece of wicker-work, may be said to comprise the list of means for preventing accidents on the ice. That some more effectual means should be adopted we think no one will deny, and we have therefore much pleasure in introducing to the notice of our readers two plans that have been suggested by our correspondent, which we trust may, at some future time, prove serviceable in rescuing from an untimely end those who would otherwise perish. The following is the communication:—

---

*To the Editor of the Penny Mechanic.*

Sir,—As that season of the year has now arrived when we may naturally expect our ponds and rivers to be frozen over, and as so many fatal accidents occur to our fellow-creatures, who venture on the ice to enjoy the pleasures of skating and sliding, I think it a duty incumbent on every one who can suggest any thing for the prevention of similar occurrences to those which took place last year, on the Serpentine, and the Canal in St. James's Park, to do so.

The means which I have hitherto seen resorted to by the men belonging to the Humane Society have been either ropes, boat-hooks, ladders, or a flat-bottom boat. When a man falls in the ice the hole he makes is seldom more than four or five feet in diameter; a rope, with a noose, (having pieces of cork strung on it to prevent its sinking) is then generally thrown to him; this he puts over his head and works under his arm-pits; he then endeavours to extricate himself by throwing his whole weight on the ice; if it is not sufficiently strong, a large portion gives way, and he is suddenly plunged under the water. The men then pull at the rope; but the force being exerted horizontally instead of vertically, the man is pressed against the edge of the ice, the rope is often broken, and the victim perishes. I saw an instance of this about the year 1817; eight persons fell into the Canal in St. James's Park, near the Pagoda-bridge. A sailor, who had been chiefly instrumental in getting them out, at last fell into the same hole himself. A rope was instantly thrown to him, which reached across the Canal, and was held by persons on each side. The man raised himself, by floating, and laid with his back across the rope, holding on at the same time with both hands; but in endeavouring to pull him out, the ice cut the rope, and he sunk, but soon rose again, and continued swimming for nearly a quarter of an hour, without any one being able to render him assistance. At length a gate was taken from the Park fences, and carried to the top of the Pagoda-bridge, which was thrown to him to lay hold of; but it fell on his head, and that which was intended for his rescue proved the cause of his death.

Instead then, Sir, of an horizontal apparatus, I propose, in the first place, a triangle, formed of poles, each about sixteen feet long (see first page); these poles to be raised so as to be about eight feet high when over the hole; and to be lashed together near the bottom to prevent their stretching; or they may have cross-pieces, formed of spars, made fast near the bottom, which will keep them in their proper position. The feet of the poles are to be stepped into small pontoons, moveable like castors on the legs of a table, and to be shod with thin slips of iron, to form sledges, and also to give a greater surface for the weight of the poles. At the top of the triangle

Digitized by Google

there is a block fitted, with running tackle attached to it. When a man falls in the ice, the machine can be slid along by means of the sledges over the hole; and if it should be considered unsafe to keep close to the pontoons, to guide the triangle, ropes are made fast to each of them, so that the men may remain at what distance they please and guide the triangle to the spot. The tackle (fitted with a noose at the end) is then lowered to the individual by one of the Society's men, who is stationed with the coil in his hand for the purpose, which he places under his arm-pits: he is then pulled up, and the machine is guided away to a place of safety, where he is lowered down.

But should the ice be so much broken as to prevent the use of the triangle, and a greater span required, I propose that two boats (as represented in the diagram),

similar to those used by the Society, but larger, should be each rigged with a mast in the centre. On the tops of these masts blocks are to be fastened: a strong line is then to be passed through the block at the top of one mast and passed over to the block on the top of the other, the ends of the rope falling on the ground. This will form a sort of suspension-bridge, which can be heightened or lowered, contracted or expanded at pleasure; and the centre of the line having a noose fitted to it, as before described, it can be lowered with the greatest ease and certainty to the individual in the water.

Should you consider my plans likely to be of any benefit to our fellow-creatures, and give them publicity through the means of your valuable Magazine, you will much oblige, Sir,

Your obedient humble servant,

H. P.

## PERPETUAL MOTION.

*To the Editor of the Penny Mechanic.*

Sir,—Although I am aware it is generally stated, that this much-sought-for result can never be obtained, in consequence of friction, sooner or later, bringing any machine in motion to a state of rest; still I am inclined to think this difficulty might be overcome, if some force could be employed to produce motion in such a way, that the force should always continue the same, and have the same power of resisting friction after the apparatus had been a length of time at work, as it had when the machine was first set in motion.

It appears to me that something of this kind might be effected by means of a syphon. It is well known that if a bent tube, having one end longer than the other, has its shorter end inserted into a vessel of water, and the other end hung over the side, if the air be sucked out of the tube, from the longer end, the water will begin to flow through it from the vessel, and run until the water is on a level with the end of the tube on the outside. This is stated to be in consequence of the column of water, in the longer end, being heavier than that in the shorter, and therefore drawing it down. Now, it has occurred to me, that if the longer end of the syphon was made of twice the diameter of the shorter one, that it then need not be much more than half the length of the short end, and might therefore hang over the water, and instead of drawing it *from* the vessel, deposit it *in it again*: thus there would be a perpetual motion.

I have never had the opportunity of putting my proposition to the test; but as, perhaps, some of your readers may have done so, or, at least, may be able to inform me whether they see any objection to it, in principle, I shall feel much obliged if you will find a corner in your interesting Magazine for this letter.

I am, Sir, your's obediently,

17*th Nov.* 1836. Enquirer.

[We have inserted our correspondent's letter, because it will afford us the opportunity of offering a few observations upon the many unsuccessful attempts that have been made, from time to time, to discover a "perpetual motion." This, if possible, we will do next week. In the mean time we may inform "Enquirer" that there *is* an objection to his proposition, resulting from a law of hydraulics, which, if he is not previously answered, we will explain to him shortly.—Ed. P. M.]

## FRICTION.

The surfaces of all bodies, when viewed through a good microscope, will be found to be full of inequalities, however smooth the surfaces may appear to the naked eye.

Digitized by Google

Therefore, when two bodies are brought into contact, the minute projections in one fit into the minute cavities in the other; and, consequently, if the bodies are put in motion, their velocity will be much retarded from this circumstance, to which the term *friction* has been applied. The same effect takes place when two bodies are brought into close connexion with each other, from their having a tendency to cohere together.

The influence of friction is so extensive, not only in the mechanical operations that man can control, but also in all the operations of nature, that a person who should neglect it in his calculations, when endeavouring to ascertain the result of any given force, would be guilty of great negligence. It may appear impossible for any one at all acquainted with mechanical philosophy to do so; yet it is quite certain, that not a few of those who have devoted their time to the discovery of a perpetual motion, never thought it necessary to calculate the result of friction; or, if they did, they under-rated it exceedingly. It is, however, the most powerful antagonistic force in nature. Not only does it stop the marble, thrown from the schoolboy's hand along the surface of the ground, but it acts as effectually in bringing to a state of rest bodies put in motion by the most powerful forces in nature.

A few familiar examples will, perhaps, best illustrate the power of friction.

When a coach descends a hill, one of the wheels is fastened, or locked, as it is termed, by which the iron tire is made to rub against the road. The friction this causes retards the velocity of the coach, and makes it descend with but little more rapidity than that with which it would proceed on level ground.

Before an engagement, the sailors on board a man-of-war, place their hammocks against the sides of the deck, in order, as much as possible, to stop the progress of the cannon-balls. One of them striking a hammock is brought to a state of rest by the friction produced in its passage through the bed.

If a billiard-ball is thrown upon the ice, it will proceed to a far greater distance than if bowled along the ground. The reason is, that in the latter case there is more friction to be overcome than in the former.

A carriage placed upon a railway can be moved with a very slight degree of force to what is required to put it in motion on a common road, where the friction between the wheels and the earth is much greater than it is on the railway. Although, as will be frequently seen, there is a greater cohesive force in the latter case. When locomotive steam-carriages were first proposed to be adopted in this country, it was thought that the friction between the wheels and the road would not be sufficient to enable the carriage to proceed. That, in fact, when the engine was put in motion, the wheels would merely revolve, without going forward. Accordingly, Mr. Gurney, who first proved the practicability of employing the steam-carriage on common roads, wasted much labour and skill in the contrivance of levers and propellers, which acted on the ground in a manner somewhat resembling the feet of horses, in order to drive the carriage forward: while, if he had previously made the experiment, he would have found, as he subsequently did, that the friction between the road and the rim of the wheel, was quite sufficient, not merely to enable the carriage to proceed on level road, but actually to ascend hills, where the inclination increased one foot in nine.

The above are a few illustrations of the influence of friction. As it acts so powerfully in diminishing the effect of all kinds of force, mechanics have always paid considerable attention to the best means of diminishing it. Rubbing surfaces, in all well-constructed engines, are avoided as much as possible: and when this cannot be done, the parts are kept well lubricated with oil, or other unctious matter, which facilitates the motion of one body upon another. It is also found, that if the substances which rub each other are of different kinds, the friction is considerably diminished. Ferguson, who made a variety of experiments to elucidate this point, found, that while the friction of polished steel, moving on brass, was only equal to *one sixth* of the weight of the rubbing substance, the friction of two pieces of soft wood was equal to *one third* the weight. In the construction of carriages this circumstance is taken advantage of. The axles of the wheels are formed of steel, and the parts they rub against are formed of brass. In watches, too, if the steel axles play on a diamond, the watch becomes far more valuable for its accuracy, as well as for the intrinsic worth of the diamond. Friction-wheels are also frequently used in machinery, for the purpose of diminishing the effects of friction. They consist of wheels, on which the axis of another wheel revolves.

The quantity of friction is always proportional to the *weight* of the substance moving upon another, and not to the *quantity* of surface, as might at first be sup-

Digitized by Google

posed. It has also been found that friction increases with an increase of velocity, although it is not proport onal to the increased celerity with which a body moves.

It must not be supposed, because friction has a tendency to destroy motion, that it is therefore prejudicial. "Were there no friction, all bodies on the surface of the earth would be clashing against one another; rivers would dash with unbounded velocity, and we should see little besides collision and motion. At present, whenever a body acquires a great velocity, it soon loses it by friction against the surface of the earth; the friction of water against the surfaces it runs over soon reduces the rapid torrent to a gentle stream; the fury of the tempest is lessened by the friction of the air on the face of the earth; and the violence of the ocean is subdued by the attrition of its own waters. Its offices in works of art are equally important. Our garments owe their strength to friction; and the strength of ropes, sails, and various other things, depend on the same cause: for they are made of short fibres, pressed together by twisting: and this pressure causes a sufficient degree of friction to prevent the fibres sliding one upon another. Without the friction, it would be impossible to make a rope of the fibres of hemp, or a sheet of the fibres of flax; neither could the short fibres of cotton have ever been made into such an infinite variety of forms as they have received from the hands of ingenious workmen. Wool also has been converted into a thousand textures for comfort or for luxury, and all these are constituted by fibres united by friction. In fine, if friction retards the motion of machines, and consumes a large quantity of moving power, we have a full compensation in the numerous and important benefits which it ensures to us." So it is with nearly every other operation of nature; the same cause which at one time may produce much temporary evil, at another time will be productive of permanent and extensive good.

## ATMOS THE GIANT.

NO. II.

THOUGH Atmos had shown himself so obsequiously obliging, he had also given undeniable proofs, not to be mistaken, that he was not to be trifled with. He partook very much of that John Bull sort of disposition so common at that time in the country where he was taken most notice of; that is, though willing, nay, anxious, to remain in his proper place as the servant of man, yet he was likewise possessed of a deep and abiding sense of his own merits, and a sturdy determination to resent, to the utmost, every encroachment upon his rights. A striking, but most appalling instance of this occurred soon after he began to be in favour. A young man, perfectly acquainted with the conditions of the spell, ordered one of the giant's family to cook his dinner; the young giant appeared immediately, and proceeded to do as he was bid. However, his employer, on being "sharp set," and desiring to hurry him, broke the rules, stopping forcibly a hole out of which he was breathing, and for his temerity was punished in the most summary manner with instant death; thus affording a terrific example of the nervous irritability of Atmos under oppression. The fearful vengeance which the giant took on this occasion procured him more respect even than usual, and the magicians who employed him proceeded to act with more caution: in fact, it was even contemplated by some to give him up altogether, as being too dangerous a servant for so feeble a master as man. While, however, this important matter was in agitation, and his employers were debating, pro and con, upon the subject, one of them, more sagacious than the rest, extricated them at once from the necessity of discontinuing his valuable services; informing them that he had discovered a method by which the giant's rising anger might be pacified without the intervention of man. Overjoyed at this intelligence, they willingly availed themselves of it, and now proceeded with greater ardour to prosecute their studies; each in general striking out different and untrodden paths, and raising his own fabric on the foundation of principles common to all.

It shall now be our task to follow the principal of them, and to give an account of the discoveries they made in common with the profitable employment of this new species of labour, and this we propose to do under so many heads or chapters.

### *Atmos employed by an Apothecary.*

A magician of Italy, who was also an apothecary, having studied the temper of the giant, conceived it possible to persuade him to pound some drugs for him in a mortar, as he found it to be very hard labour, and knew the giant to be much stronger than he. Proceeding, therefore, with due caution, he made some advances to him, just to sound his disposition; and

Digitized by Google

finding him subservient to his wishes, he acted with greater boldness; in fine, he plainly asked Atmos if he would condescend to blow a wheel, (provided with a sufficient number of floats), round with his breath. The giant replied that he would, if he would allow his father (he made no request for himself) a sufficient quantity of food, and by no means stint his aged parent of his allowance. To this arrangement the Italian readily consented, and proceeded with diligence to make ready the apparatus with which Atmos condescended to work; which being erected, the spell was used, and the giant, true to his word, speedily appeared to set the whole in motion; and the magician soon found that the better the father was fed the better the son (a pattern for all sons) worked in return; and whenever the former was in the least pinched in his stipend, the latter, just in the same proportion, flagged and grew weary, which was immediately remedied by supplying the deficiency. The drugs which he pounded were found fully equal to those pounded in the ordinary way, and his praise was in the mouths of all who witnessed his wonderful performances, which was the case with no small number. But flattering as this homage to his abilities was, he was not in the least affected by it, for he was a being that seemed to be incapable of pride; he still moved on in the same dogged stern old Roman way as ever, rendering no thanks for his wages, and caring for none in return for the feats he performed; night and day would he labour, if required, without the least grumbling or sign of dissatisfaction. He was always ready to obey the commands and attend to the wishes of his master; the most faithful of all servants; the most affectionate of all children; the most unconcerned of all courtiers, and the most tyrannical of all rebels when he once broke out into insubordination. He was at once a patriot and a slave, obedient to all, yet caring for none; unmoved by the changes of empires, thrones, and dynasties, as by the whistling of the wintry wind; and, in a word, incomprehensible as the native of a world and order of things entirely different from our own.

YOUNGSTER.

### MR. POCOCK'S KITE CARRIAGES.

THIS unique and ingenious invention of Mr. G. Pocock, was witnessed by many of the members of the British Association, lately, on Clifton and Durdham Downs, near Bristol, and called forth their unqualified approbation. The starting-place was opposite the Observatory. The car, containing four persons, was drawn by two kites—the pilot kite ten feet in length of standard, the draft kite, twelve feet. The party passed through the turnpike with all the privileges of royalty,* toll free, and proceeding across Durdham Down, ended their journey near Westbury. The general pace was about ten miles an hour. Two days after this first display, four carriages were on the downs, two of which were in constant use for several hours. During the day, about one hundred ladies and gentlemen, many of them foreigners, had an opportunity of riding in these novel vehicles. When the wind was active, the pace was about twelve miles an hour. Many of the gentlemen present expressed their surprise at the power of the kites, and were especially gratified at witnessing the scientific management of them, for they had not conceived that every angle or obliquity of surface could be given to the kites which can be presented to the wind by the varied setting of a sail, or the mast of a boat. From this discovery many judicious remarks were made on the various use to which these kites, or buoyant sails, might be applied. Ideas, new even to the author of the invention, were suggested. The general impression was, that it was peculiarly well adapted for sea service, especially in case of shipwreck, as life preservers, as auxiliary sails, and for the making of signals. It is hoped, therefore, that this hitherto-uninvestigated branch of science will be more fully developed, and applied to beneficial purposes. The most mortifying occurrence of the day was, that, after Lord Courtenay had minutely examined the whole apparatus, and tried every brace line with his own hand, in order to prove its use, and to ascertain the effects produced on the kites, when his lordship had taken his seat for a ride, the wind became so feeble that the general pace was not more than six miles an hour.

On a subsequent occasion an immense

* Mr. Pocock may, in fact, claim a royal appellation for his car, Prince George of Cumberland having had a seat in it, and "handled the ribbons" of the aerial steeds.

Digitized by Google

kite, of thirty feet length in the standard, was exhibited on the Downs, the power of which was adequate to the drawing of four carriages laden with persons. The most speedy rate of the carriages was eighteen miles an hour.

Though not scientific, to start a new theory as to the applicability of these kites, we were delighted with the control which Mr. Pocock possesses over a team elevated some hundred yards above him. By means of reins (or, as he terms them, brace), he is enabled to bring the kites round to any one point, even almost to a right angle with the road he is travelling, and can put them to an edge with the wind, or allow them its full force. Even the tail is pressed into the service of propulsion, being a series of linen cones, each of which catches what sailors so often long for, "a cap full of wind."

## CHARRING OF ANIMAL SUBSTANCES.

A pamphlet published at Florence gives an account of a strange discovery by Girolamo Legato, the accuracy of which is attested by the principal professors in that city. It appears that Legato, while traversing the deserts of Africa, in 1820, for the purpose of perfecting his map, discovered in one of the hollows which a whirlwind had ploughed up, a completely charred human body, the flesh and bones of which were in good preservation. It struck him that the process of charring could only have been effected by the scorching sand, and that if the heat of the sand had, in this instance, effected the complete desiccation and carbonization of animal substances, it might be possible to effect something similar by artificial means. On his return to Italy he commenced his experiments, and at length succeeded in imparting to the limbs and bodies of animals solidity and indestructible durability; by this process, whole bodies, as well as individual parts, acquire a thoroughly firm consistence, which is more decided according as the respective parts are harder or softer. The skins, muscles, nerves, veins, fat, blood, all undergo this change without its being necessary to remove the intestines, which assume the same consistence. At the same time the colour, form, and character in general, remain unchanged; no smell is perceptible, and both joints and limbs remain flexible and moveable, as when alive; when bodies have acquired this consistency, neither damp, air, moths, nor water, can affect them. The weight is but slightly diminished; not a hair is lost; on the contrary, they are rooted more firmly than ever. Birds and fishes lose neither skins, scales, nor colours; and, in like manner, insects and worms remain perfect in every respect. Legato's cabinet contains many specimens of this novel and singular discovery; one of the most remarkable is a table composed of 214 pieces joined together. The observer would take them for so many different kinds of stone, and yet they are nothing more than portions of the human members.

## THE PATENT RETARDER;

### OR, THE TRAVELLER'S SAFEGUARD.

A most satisfactory exhibition of this new and important invention took place during the three former days of the present week, upon Highgate-hill: we say important, for who of our readers at all accustomed to stage-travelling, has not oftentimes been the subject of fear and even of terror, when seated behind spirited horses upon the brow of some fearfully-steep hill, at finding the entire control of them is left in the hands of an inexperienced passenger, or, it may be, some foppish coxcomb, whose *halfpence* to the stage-porter has secured the box-seat, and who fails not, during the temporary absence of the coachman, to "try what the whip is made of," by smacking it right and left, fore and aft, and at every little kindred *puppy-dog* that happens to pass by; and all at the imminent hazard of the lives of his fellow-passengers. We rejoice, however, to state, that by the Patent Retarder the necessity for adopting any dangerous resources is superseded, as the following will show:—

1st.—In descending a hill, the coachman or guard can, without alighting from, or stopping the coach, apply the retarding power to both hind wheels, imperceptible to the passengers; so that the whole pressure of the coach be taken from the horses, the speed of the coach regulated to any rate, or stopped at pleasure at any spot. The retarding power can be ap-

Digitized by Google

plied equal in effect to an additional draft of several tons.

2nd.—In ascending a hill it is necessary to stop the horses, to enable them to recover the exhaustion occasioned by the severe draft up it; to do which the coach is set across the road, to prevent its running back, and give ease to the horses at the collar; the patent Retarder applied, immediately fixes the coach, allowing the horses to be perfectly free at the collar, with the traces loose; and indeed, if the wheelers were to back, they have not the power to force the coach back with them, without great difficulty.

3rd.—When it is necessary for a coach to stop, and the coachman leaves the box, he places the reins in the charge of a passenger, or else leaves a horse-keeper or his assistant, at the horses' heads, in both cases, numerous accidents have occurred by the horses starting and running away, having nothing but their accustomed load to draw; the Retarder, applied by the coachman when he leaves the box, would effectually secure the coach, as the horses, having to contend against its power (equal to several tons additional draft), would be impeded, and prevented from moving far.

4th.—Frequent accidents occur to passengers when getting up and down a coach, which is occasioned by the horses moving on, or being restless, thereby making the coach unsteady, overthrowing the ladder used by the passengers (females particularly), or causing the passengers who may be using the hand wheel to become alarmed; the Retarder applied, would as effectually fix the coach, and prevent the horses moving as in the last case.

## INSTITUTIONS.

*Meteorological Society*—Dr. Birkbeck, President, in the Chair.—A meeting of the members of this Society, and others favourable to its objects, was held on Tuesday, the 15th instant, in the committee-room of the Mechanics' Institution, 29, Southampton-buildings, Chancery-lane. The Society has been in a state of inactivity for several years, and we anticipate its revival will be hailed with great pleasure by every meteorologist. After the business of the meeting had been ably set forth, at considerable length, by the learned President, Charles Shearman, Esq., was elected Treasurer in the place of Dr. Clutterbuck, who resigned; and W. W. White, Esq, M.B.S., of No. 4, Worship-square, was elected Secretary, in the place of Thomas Wilfred, Esq. It was resolved, "That every gentleman disposed to join the Meteorological Society be admitted on presenting his name to the Society, and paying one guinea (his annual subscription) within a period of three months. Members to be afterwards admitted by the usual mode of ballot." The meeting was then adjourned to the second Tuesday in December, when W. R. Bish, Esq., author of the *Tubulæ Anemologicæ*, will read a paper on the periodical curves described by the wind.

*Botanical Society*, Adelphi Chambers—J. E. Grey, Esq., F. R. S., in the chair.—At a general meeting of the members of this Society, held on Thursday evening at their rooms, 11, John-street, Adelphi, a very interesting paper on local botany was read by A. Irvine, Esq., of Croydon, a very able botanist. In this paper the flora of the vicinity of London was contrasted with the local floras of different localities in England, Scotland, and various continential states.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday, at seven o'clock W. T Brande, Esq., on Chemistry. Thursday afternoon, at one o'clock, W. Chalklen, Esq., on Taste.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Basil Montague, Esq, on Knowledge, Ignorance, Error, Prejudice, and Reform, at half-past eight. Friday, Anniversary. *A Conversazione.*

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, at half-past eight o'clock, W Chalklen, Esq., on History.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge road.—Tuesday evening, at half-past eight o'clock, Dr. Southwood Smith, on the Animal Economy.

*Islington Literary and Scientific Society*—Thursday, at eight o'clock, Mr. Elliott, on the Education of the Senses.

*Eastern Literary and Scientific Institution*, 88, Hackney-road.—Tuesday, Mr. Elliott, on the Education of the Senses.

*Mutual Instruction Society*, Great Tower-street.—Monday, at eight o'clock, B. R. Haydon, Esq., Elements of Painting and Sculpture.

### TO CORRESPONDENTS.

We shall have much pleasure in inserting communications from *Mechanics* and others, no matter what their style of composition may be, if their information is likely to prove interesting.

"A." We cannot comply with his request. The Committee of the "Mechanics' Institution" may have acted harshly in the case referred to, but those who feel aggrieved can bring the subject before the whole of the Members at a general meeting.

"A City Apprentice" shall have his queries answered, in a short article next week.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

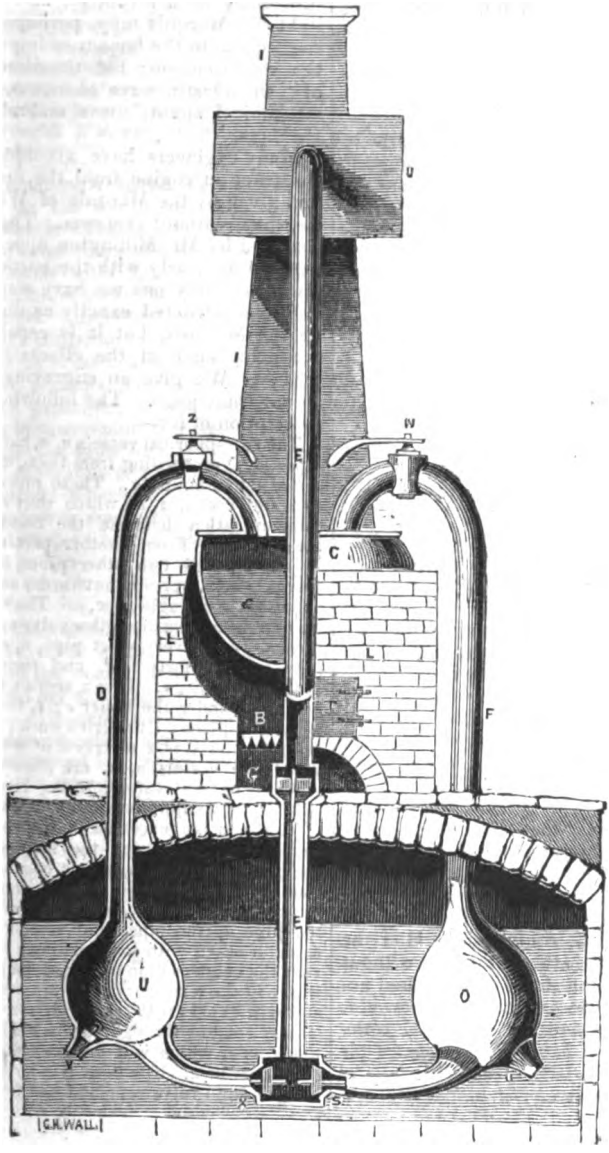
Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. V.] SATURDAY, DECEMBER 3, 1836. Vol. I.

## THE MARQUIS OF WORCESTER'S ENGINE.






Holloway Press: D. A. Doudney.

Digitized by Google

## THE STEAM ENGINE.

### NO. III.

THE merits of the Marquis of Worcester, as an improver of the steam engine, have, we think, been overrated. His claim rests entirely on the description of the machine described in the "Century of Inventions," and quoted in our last paper on this subject; but the description is so exceedingly vague that it has been found impossible to construct an engine from it. Many scientific men of eminence have doubted whether such an engine was ever made, although the Marquis most positively declares that he performed the experiments with it, he describes, before the Court of Charles the Second. Whether this was the case or not, it is certain that, long before the Marquis lived the elastic power of steam had been discovered and operated upon by De Caus, whose engine we described in No. 3, where an engraving of it will also be found. We mention this, because Dr. Lardner, in his Lectures on the steam engine, appears to have entirely overlooked De Caus's invention. He says, "Whether the Marquis of Worcester ever tried the experiments he mentions, or constructed the machine he alludes to, is, we conceive, a matter of perfect and absolute indifference as to the share to which he may be considered to be entitled in the invention of the steam engine. It is quite clear, that, in the passage we have quoted (in the "Century of Inventions,") he distinctly points out the pressure arising from the elastic force of steam as a mechanical agent. He gives an instance of the possibility of applying it to elevate water, and mentions the advantage which, in this respect, it possesses over the atmospheric pressure, viz., that the latter has a limit, not being capable of supporting more than about thirty-four feet of water, while the pressure of steam has no other limit than the strength of the vessels which contain it. Had he merely stated these things, without alleging, as he does, that he had actually tried the experiment, he would, we conceive, *have an undeniable claim to the merit of having first suggested the elastic force of steam as a mechanical agent of a power almost unlimited;* and beyond this, even had he made his experiment publicly, his claim could not be admitted; for it is certain, that no engine, constructed in the manner to which he alludes, could be rendered extensively useful as a machine even for raising water." It not unfrequently happens, that men *re-invent* what has previously been invented; and in this light the Marquis may, perhaps, have some claim to the honour of improving the steam engine; but the discoverer of "the elastic force of steam, as a mechanical agent," was undoubtedly De Caus.

Many engineers have attempted to construct an engine from the description given by the Marquis of Worcester, but without success. The one designed by Mr. Millington appears to agree more nearly with the particulars given than any one we have seen. It is not constructed exactly as directed by the Marquis, but it is capable of producing some of the effects he describes. We give an engraving of it on our front page. The following is a description of it:—

The two spherical vessels *u*, *o*, have two pipes, *d*, *f*, proceeding from them, and inserted into a boiler, *g*. These pipes have two stop-cocks, *z*, *w*, which shut off the communication between the boiler and the vessels. From another part of the vessels proceed two other pipes, having valves at *s*, *x*, opening outwards, and terminating in a single pipe, *e*. The spherical vessels have each another valve opening inwards, and a very short pipe, *n*, *v*; the pipe *e*, rises forty feet, and terminates in the reservoir, *u*. *b*, is a section of the fire-grate, under the boiler *e*; *t*, the door of the fire-place; *l*, the brickwork; *g*, the ash-pit; and *h*, is a reservoir of water in which the vessels *u*, *u*, are placed, and which is to be elevated into the cistern *u*.

If we now suppose a sufficient quantity of steam to be generated in the boiler *c*, from the water *g*, and the stop-cock *z*, opened so as to allow a free communication between the boiler and the vessels in the reservoir, the steam will descend in the pipe *d*, (the pipes and vessels being made or cased with some material to prevent the condensation of the steam by the water in the reservoir), into the vessel *u*, and will expel all the water or air which it may contain through the valve *s*, into the pipe *e*, which will deliver itself into the reservoir *u*. The cock *z* is now to be shut, and the valve *v*, being freed from the

Digitized by Google

pressure of the elastic vapour, will be forced inwards by the gravity of the water in the reservoir, which will speedily fill the vessel *a*. But when the cock *z*, is shut, the opposite one, *w*, is opened, and the steam from the boiler raises the water which may be contained in *o*, up the pipe *e*, closing in this operation the valve *s*. When the vessel *o*, is filled with steam, the cock *w*, is shut, and the water in the reservoir rushes into *o*, as it did into *a*, and fills it. The cock *z*, is now opened, and the steam again expels the water from the vessel *a*; and so on successively, so long as steam is produced in the boiler, and the cocks *z*, *w*, are opened and shut alternately

We must now leave the reader to decide on the merit to which Lord Worcester is entitled, and proceed to describe some more improvements that were shortly after introduced in the construction of steam engines.

Amongst numerous other persons who have contributed to bring this machine to its present state of perfection, without, perhaps, having pointed out any new principle, or suggested any striking improvement, Sir Samuel Moreland deserves to be mentioned with respect. Although it is known that he constructed apparatus, of which the moving power was steam, and that it was exhibited before the King of France, yet no drawing or description of it is extant. His experiments on steam, however, are sufficient to entitle him to the honour of being mentioned with the other great men who have improved the steam engine. The experiments are remarkable for their accuracy. His estimate of the degree of expansion that water undergoes when converted into steam, is found to be perfectly correct. He says "Steam is about 2,000 times the volume of the water from which it was produced." This is the case, although Ferguson, Desaguliers, and many other scientific men, for a long time, thought that water expanded 14,000 times to form steam! Watt, however, proved that Moreland's estimate was the correct one.

Within a year or two after Sir Samuel Moreland had performed his experiments in France, Dr. Papin, the well-known inventor of "The Digester," also had his attention directed to the expansive power of steam as a mover of machinery. He was engaged for a long time in endeavouring to discover the best means of forming a vacuum in a very large air pump, that he constructed for the purpose of raising water. Amongst other things, he was led to experiment on steam for this purpose; and he found that, "by converting a little water into vapour, by fire applied to the bottom of the cylinder that contains it, the vapour forces up the plug or piston, in the cylinder to a considerable height; and which, as the vapour condenses (as the water cools when taken from the fire), descends again by air pressure, and is applied to raise water out of the mine." This, as will be seen hereafter, was a description of an atmospheric engine; but Papin himself did not profit by his suggestion. He constructed an engine some years afterwards, yet this was only an improvement on De Caus's; the steam not pressing on the surface of the water in the boiler, and thus forcing it up a pipe, but was generated in a separate boiler, and made to pass through a pipe into a cylinder containing *cold* water. Upon the surface of this a floater was placed, which prevented the steam coming into contact with the water, by which the former would have been condensed. The pressure of the steam on this floater was the means of forcing the water contained in the cylinder up a pipe continued from the bottom of it.

Dr. Papin made a valuable addition to the steam engine by introducing a safety-valve for the boiler

## ANTICIPATED RESULT OF EDUCATION.

What claim is there to which that of National Education is not paramount? Instruction, free instruction, might be brought home to every door. In fact, it should be obligatory, giving the parent the option, of himself, or by private instruction, of educating his child in preference. But as the power of life and death, which was once possessed over the child's body, has been taken away, as a barbarism, why should that of life and death over the soul be upheld? What a moral magnificence would there be in an universally edu-

Digitized by Google

cated people! The joy in heaven over a sinner that repenteth would swell to rapture over a great nation repenting and regenerated; and blessed spirits look down from their seats of glory, with tears of delight. O! how much of the poverty that fills our streets with misery; how much of the temptation that crowds our gaols with criminals; how much of the erroneous struggling that exasperates our population to animosity that sometimes threatens to dissolve the bonds of society, would vanish with the education of the people! How many of the absurd prejudices and institutions which bewilder the true notions of right and wrong, and make so many victims in all ranks of society, would speedily wear out, as the philosophy of Christian morality applied itself to perfecting the science of virtue, and the art of happiness! How would knowledge ascend and expand, till the whole form of society would rise into its fair and full proportions; and our country commence the grand advance towards the ultimate destiny of man upon earth—that of universal association for universal good! For when knowledge shall cover the face of the earth, even as the waters cover the sea, like those waters it shall unite the remotest nations, and reflect heaven's brightest loveliness. Knowledge is the scource of virtue; virtue is the means of happiness; happiness is the pledge and earnest of immortality; and so ascends the golden chain of human destiny, from the dust of earth, to the throne of God in heaven.—*W. J. Fox.*

## FLUID RESISTANCE.

MANY persons entertain exceedingly erroneous ideas with respect to the velocity that may be obtained by a vessel in sailing, or by a boat propelled by oars. We have heard of the captain of a steam-boat, that was not calculated to sail with great rapidity, having placed his foot on the safety-valve of the boiler, when racing with another boat that could go nearly twice as fast as his, and declaring, with an oath, that he and all the passengers would be blown into the air before the boat he commanded should be beaten. He was not aware of the great increase of power necessary to make a body move with a double velocity in water; and many well-informed persons are not much better acquainted with the subject. The following remarks by Arnott may therefore not be uninteresting.

The same force is required to give, or to take away, or to bend motion, in a fluid, as in an equal quantity of solid matter. A pound of water, enclosed in a bladder, is not more easily thrown to a given height than a pound of ice, or of lead; nor, if falling into the scale of a weighing-beam, does it require less as a counterpoise; nor if made to revolve at the end of a sling, does it render the cord less tight.

Many persons, looking carelessly at this subject, would expect, that if a body, moving through a fluid at a given rate, meets a given resistance, it should just meet double resistance when moving with double speed. Now four times the power is required to produce a double rate.

This fact, when more closely examined, is easily understood. A boat which moves one mile per hour, displaces a certain quantity of water, and with a certain velocity; if it move twice as fast, it, of course, displaces twice as many particles in the same time, and requires to be moved by twice the force on that account; but it also displaces every particle with a double velocity, and requires another doubling of the power on this account: the power then being doubled on two accounts, becomes a power of four. In the same manner, with a speed of three, three times as many particles are moved, and each particle with three times the velocity; therefore a force of nine is wanted to produce thrice the speed; for a speed of four, a power of sixteen is wanted; for a speed of five, a power of twenty-five, and so forth. The corresponding numbers, up to a speed of ten, are shown in the following table:—

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Speed | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Corresponding resistance | 1 | 4 | 9 | 16 | 25 | 36 | 49 | 64 | 81 | 100 |

Thus the force of 100 horses would only drag a boat *ten* times as fast as the force of one horse. Arithmeticians express the relation shown in this table, by saying *that the power required to move a body in a fluid increases as the square of the speed.*

There is not a more important truth in physics than this; it explains so many phenomena of nature, and becomes a guide in so many matters of art. We shall now set forth some interesting examples chosen

Digitized by Google

indifferently from the two classes mentioned.

The law explains at what a heavy expense of coals high velocities are obtained in steam-boats. If an engine of 49 or 50 horse-power would drive a boat seven miles an hour, two engines of 50, or one of 100, would be required to drive it 10 miles, and three such would only drive it 12 miles. For the same reason, if all the coal which a ship could conveniently carry were just sufficient to carry her 1,000 miles, at the rate of 12 miles per hour, it would drive her 3,000 at the rate of seven miles per hour; and nearly 6,000 at the rate of 5 miles per hour. This is a very important consideration for persons concerned in steam navigation to distant parts.

The same law shows the folly of putting very large sails on a ship: the trifling advantage in point of speed by no means compensates for the additional expense of making and working the sails, and the risk of accidents in bad weather. The ships of the prudent Chinese have not, for the same tonnage, one-third so much sail as those of Europe, and yet they move but a little slower on that account. An European ship, under jury-masts, does not lose so much of her usual speed as most people would expect.

This law explains also why a ship glides through the water one or two miles an hour when there is very little wind, although, with a strong breeze, she would only sail at the rate of eight or ten miles. The 100th part of that force of wind which drives her ten miles an hour will drive her one mile per hour, and the 400th part will drive her half a mile. Thus also, during a calm, a few men pulling in a boat can move a large ship at a sensible rate. The same law applies where the fluid is aeriform as well as where it is liquid.

A bullet shot through the air with a double velocity, for the reason assigned above, experiences four times as much resistance as with a single velocity, and it is further true, that when the velocities of bodies moving in air are very great, the resistance increases in a still quicker ratio than in liquids,—probably because the compressibility of air allows it to be very much condensed or heaped up before the quick moving body. It is useless to discharge a cannon-ball with a velocity exceeding 1,200 feet in a second, because the powerful resistance of the air to any velocity beyond that, soon reduces it to that at least.

The rule of mutual action between a solid and fluid, now explained, holds equally when the fluid is in motion against the solid, as when the solid moves through the fluid.

If a ship be anchored in a tide's way where the current is four miles an hour, the strain on her cable is only one-fourth part as great as if the current were eight miles.

A wind moving three miles an hour is scarcely felt; if moving six miles it is a brisk gale; if sixty it is a storm; and beyond eighty it is a frightful hurricane, tearing up trees and destroying every thing.

Supposing the wind to move one hundred miles per hour, there are one hundred times as many particles of matter striking any body exposed to it, as when it moves only one mile per hour, and each particle strikes moreover with one hundred times the velocity or force: therefore the whole increase of force is a hundred times a hundred, or ten thousand. This explains how the soft invisible air may, by motion, acquire force sufficient to unroof houses; to level oaks which have been stretching their strong roots around for a century; and in some West-India hurricanes, absolutely to brush every projecting thing from the surface of the earth.

No ship can sail faster than fifteen miles in an hour.

No fish can swim with a velocity exceeding twenty miles an hour; not the dolphin, when shooting a-head of our swiftest frigates; or the salmon, when darting forward with speed which lifts him against a water-fall of many feet.

## RISE OF SAP IN TREES.

*To the Editor of the Penny Mechanic.*

Sir,—Permit me to offer the following explanation in reply to a query inserted in No. III., "What is the cause of the rise of sap in trees?"

The growing points, or extremities of the buds, are composed of what is called cellular tissue, a mass of minute bladders of vegetable membrane, filled with sap, and permeable by pores so extremely small as to be invisible under the most powerful microscopes. Each of these bladders is capable of developing others of the same kind upon its sides, which thus drain it of its sap. In order to restore an equilibrium, the adjoining vesicles part with a portion of the sap they are charged with, supplying themselves in turn from those below; thus the circulation is excited throughout the stem and the root; which last takes up its juice from the soil. The generative power pos-

Digitized by Google

sessed by the tissue of plants is increased in proportion to the quantity of heat and solar light; consequently the flow of sap is renewed by the returning warmth of spring, and again falls off at the approach of winter, but never entirely ceases except under the influence of severe frost, when the current of sap is observed to take a retrograde motion, returning down the stem, and discharging itself by the root. R.

[The power by which circulation of the nutritive fluid, in organized beings, is effected, whether it be of the blood, or sap, is involved in much obscurity. Physiologists have no means of knowing positively how the circulation is carried on in the capillary terminations of the vessels, and can therefore only theorize upon the matter. We are much obliged to our correspondent above, for attempting to explain the subject, but we must confess we do not clearly understand him, when he says, speaking of the cells which compose the cellular tissue, "each of these bladders is capable of developing others of the same kind upon its sides, which *thus* drain it of its sap." Capillarity is, no doubt, one of the causes of the circulation of the sap, but the vessels also have a living power. We should be obliged if some of our botanical friends would favour us with a short paper, containing a digest of the opinions of some of the able vegetable physiologists of the day, upon the rise of the sap in plants, &c. If we do not receive a communication of this kind, we will shortly introduce the subject, as it is an interesting one, to the notice of our readers.—Ed.]

## INCREASED TEMPERANCE OF THE WORKING CLASSES.

We recommend the following remarks, which are taken from an article entitled "Social Improvement," in the *London Magazine, and Journal of Educational Institutions, for October*, to the notice of those members of the Temperance Societies, who are continually affirming that the people are less temperate now than formerly.

One cause that has led to the belief that intemperance is more prevalent than formerly, is the splendour of the places where ardent spirits are retailed. While the dram shops presented no striking peculiarity to attract attention, they remained, to a certain extent, unnoticed, except by those who frequented them. But when we find that a publican can afford to spend some hundreds of pounds, merely for the plate glass of his windows, it is not an unreasonable conclusion that his profits are greater than formerly, and that drunkenness has consequently increased. The splendid decoration of these "Temples" is the principal cause of our noticing them; for within the last century their *number* has materially decreased. Mr. Francis Place, in his evidence before a Committee of the House of Commons, on drunkenness, stated, that in 1736 the number of dram shops within the bills of mortality was not less than *twenty thousand*. In 1831 the number did not exceed *five thousand*. At the former period gin was even retailed on barrows in the street, and the quantity consumed was of course very great. The number of gallons of spirits used in England and Wales, in 1742, exceeded twenty millions. The population at this period was about six millions; in 1832 the population had increased to above fourteen millions. If, therefore, only the same demand for ardent spirits had continued, nearly three times as much would be required now as at the first-mentioned period; instead of which, in 1833, the consumption of spirits was about twenty-six million of gallons, *only three million more than at the former period*, when the population was but little more than a third of what it is in the present day.

The increase in the price of spirits has greatly contributed to check intemperate habits. In 1745, gin (the liquor most generally used), was not more than three-pence or fourpence the pint; at present it is four times that price. This difference will not appear so surprising when it is considered that at the former period private stills were in general use, and that the present tax on gin is 930 per cent. Mr. Mc. Culloch, in his Dictionary of Commerce, article "Geneva," in reference to this, states, that "In 1786 Mr. Pitt reduced the duty on gin to five shillings per gallon. During the ten years from 1796 to 1806 the consumption of Geneva went on increasing till it reached 724,351 gallons a year. The duty has since been raised, and at present (1832) is 1*l*. 2*s*. 6*d*. the imperial gallon, on an article which may be bought in bond for 2*s*. 3*d*. or 2*s*. 6*d*. The duties on rum and British spirits having been materially reduced during the last 10 years, the consumption of Geneva has gone on progressively diminishing till it now amounts, as appears from a subjoined official statement, to no more than 35,300 gallons; being only *one-twentieth* part of what it amounted to during the ten years ending with 1806."

Digitized by Google

We consider these facts, which are taken from Reports of Committees of the House of Commons, quite sufficient to prove that drunkenness has not increased; but if any further evidence should be required, we think it will be found in the circumstance, that while the demand for ardent spirits has diminished, the desire for less stimulating beverages has greatly increased. Sir Robert Peel, while Chancellor of the Exchequer, last year, in his speech against the reduction of the malt-tax, stated, that in 1722, the quantity of tea consumed in this country was, on the average, about one ounce by each of the population; in 1833, the average was two pounds and a quarter by each person! The increase in the quantity of coffee used is quite surprising. In 1760, the average was about three quarters of an ounce for each person: in 1833 it was one pound and a-half! The circumstance of so great a change having been effected in the tastes of the people would of itself, we think, be sufficient to prove that intemperance has not increased; but the facts previously stated, are taken from documents, the accuracy of which cannot be doubted, and the conclusion is therefore, irresistible, *that the people are more temperate in their habits now, than they were during the last century.*"

## REMESLENNOE LAVEDENIE, OR MANY-HANDICRAFT SCHOOL, AT MOSCOW.

[We have been favoured with the following communication from a gentleman residing in Moscow, who is most anxious to promote the cause of education, and has done us the honour of selecting The Penny Mechanic for the purpose of making the above excellent institution known to the people of this country. We have much pleasure in drawing our readers' attention to the account, not only because it is highly interesting, as exhibiting the progress of education in Russia, but also because it contains information that, we think, might be acted on with success at the Penitentiary, Schools of Industry, &c., in England.—Ed. P. M.]

Amongst the many excellent Institutions established at Moscow, there is none more worthy of notice, of the highest praise and imitation than this; indeed, it will be difficult to do justice to this most Christian-like and truly-benevolent Institution, in transcribing the account given us by Mr. E. Matthews, who, conducted by the Director, a Mr. Ott, through the various departments, devoted several hours in examining and informing himself of the principles on which it is conducted. This establishment is a branch of the Foundling, of which it will, perhaps, be necessary to speak first, and was supported from the funds of that establishment until it was able to support itself. It is pretty generally known that the Foundling at Moscow is one of the most superb structures, and extensive establishments, in Europe; upwards of ten thousand persons living and being supported within its walls; and the children brought up there receiving a most liberal education. But as, amongst several thousand children, some are necessarily to be found incapable of receiving (that is to profit by it) a sufficient knowledge of the arts and sciences, those who are thus deficient in talent are transferred to the school of which we are now speaking, and are there brought up in the following manner:—If found to be very dull, they are first put to the most simple employments, such as making small card-boxes, or forming little wooden toys with one instrument. As they improve in this, they are instructed in carving in wood, or in turnery. Those with more mind would be instructed in etching and engraving, or in some branch of mechanics, conducted by the easiest methods; and they are so far advanced as to have formed a beautiful model of a very complex cotton-combing machine, a steam-engine, and several other things equally difficult: thus are several hundred boys becoming clever mechanics, and many skilful engineers; and, what is an important addition to this, they also receive a plain education, are instructed in writing, arithmetic, and drawing, by good masters, who teach after the Lancasterian plan; and the whole routine of teaching is carried on with such order, and still without severity, that Mr. Matthews assures us, he would not hesitate in placing his own son under its rules. That the manner of living, the cleanliness and positive comfort of the boys, is such, that a nobleman's son could not be better treated. One circumstance alone, though trifling in itself, may give an idea of the noble manner in which it is conducted. The Director has sunk ten thousand rubles in plate (the spoons and soup-ladles being of silver), and which he considers is not only more agreeable, but, in the end, even a saving—as the circumstance of one being lost has not yet occurred. Mr. Matthews describes the coming of the boys to and from their supper, or last meal, at seven o'clock, as a most pleasing sight; the perfect order in which they enter the dining-room, under conduct of the elder

Digitized by Google

boys; their hymn, so very pleasingly sung before they sit down; and the steadiness of the monitor, or elder boy, who sits at the head of the table and serves the soup, was certainly a most pleasing sight; because it must not be forgotten that these boys are the offspring of the lowest class, who would otherwise have had to live in indigence, and, what is worse, in ignorance approaching the brute state, but who are now raised to a rank among their fellow-creatures; and, from the powers they possess of procuring a livelihood when sent into the world, may feel a justly conscious sense of their utility and independence. Our limits would not admit of our giving the full delail of this benevolent Institution, as given us by Mr. Matthews; suffice it to say, that it would be well worthy of imitation, even by so great a nation as England; for the only Institution which in any respect approaches to it, is the Philanthropic, which is not only deficient in many material points, but is also on so limited a scale, that Russia might deride the comparison. No doubt but it will be soon noticed by other travellers, as an English gentleman, who was travelling through Russia, entirely with philanthropic motives, visited the establishment about the same time as Mr. M., and expressed his deepest admiration, and highest approbation of the whole management.

Mr. M. is gone to reside at Moscow for a time, and would be happy to furnish philanthropic inquirers with every particular.

*Effect of Water on Cast-iron.*—Some large brass and cast-iron guns, which went down with the Royal George, in 1782, are now lying in the Tower. The brass ones are little affected by their long immersion in the sea; but those of cast-iron are changed throughout their whole substance. They resemble plumbago or pencil-lead, and, like it, may easily be cut with a knife. Cast-iron pumps, attached to a pumping apparatus, in a mine of 140 fathoms deep, in the north of England, have been so softened in five years, as scarcely to hold together on removal.

*Paupers in Paris.*—The indigent in Paris, without reckoning paupers, who receive relief from the municipality, amount to 62,539, and are divided into 14,499 men, 10,862 boys, 25,748 women, and 11,430 girls.

*Purification of Coal Gas.*—Mr. H. Phillips, superintending engineer of the Exeter Gas Works, has discovered the means of arrest ng the volatile alkali, to which, from its known corrosive property, when in contact with copper or brass, is to be attributed the destruction of cocks, fittings, and meters; and as azote (one of the constituents of ammonia) is highly injurious to respiration, that peculiarly pungent and obnoxious quality of the air in rooms in which gas is burnt for a long portion of the night, is probably augmented, if not procuced by it, from the circumstance of the ammonia not being previously separated: azote is alike injurious to combustion. By employing two burners of the same size, and supplying one with gas from which the ammonia has been removed, and the other with gas from which the ammonia has not been removed, the superiority of the light produced by the one over that produced by the other, will be clearly apparent. Mr. Phillips has taken out a patent for his discovery.—*Worcester Journal.*

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday, Dec. 5, at seven o'clock, W. T. Brande, Esq., on Chemistry. Thursday afternoon, Dec. 14, at one W. Chalklen, Esq., on Taste.

*Aldersgate Street Institution.*—Wednesday, Dec. 7, T. J. Serle, Esq., on the Construction of a Drama.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Dec. 8, C. Pemberton, Esq., on Elocution.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge-road.—Tuesday evening, Dec. 6, at half-past eight o'clock, J. Harris, Esq., on Elocution.

*Islington Literary and Scientific Society.*—Thursday, Dec. 8, at eight o'clock, Dr. Trueman, on the Comparative Physiology of the Voice.

*Eastern Literary and Scientific Institution*, 88, Hackney-road.—Tuesday, Dec. 6, Mr. Lukeing, on Fossil Organic Remains.

*Mutual Instruction Society*, Great Tower-street.—Monday, Dec 5, at eight o'clock, Mr. J. Robinson, Essay on Prejudice.

*Mutual Instruction Society*, Southampton Coffee-House, Chancery-lane, Thursday, Dec. 8, at half-past eight, Essay on Phrenological Fallacies.

## TO CORRESPONDENTS.

For the convenience of Subscribers living in the country, a Monthly Part will be published ready for delivery with the Magazines.

"J. L." in our next. Also, "School of Design."

We shall have much pleasure in inserting communications from *Mechanics* and others, no matter what their style of composition may be, if their information is likely to prove interesting.

We are compelled to postpone a report of Dr. Birkbeck's interesting Lecture on Meteorology till our next Number.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

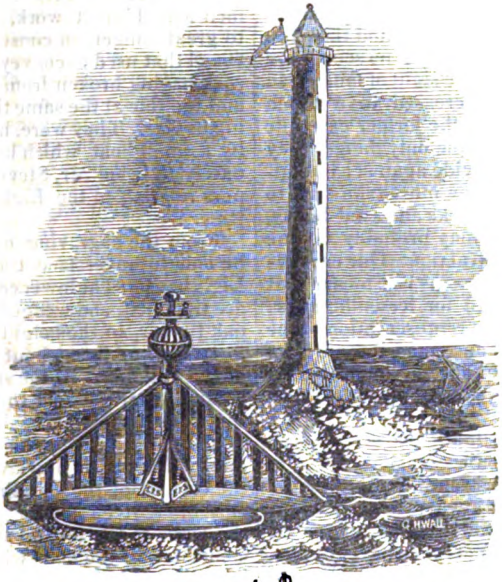
Digitized by Google

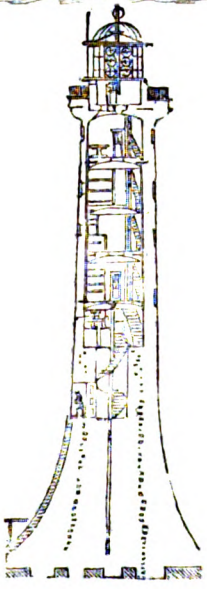
# THE PENNY MECHANIC,

A MAGAZINE OF ARTS AND SCIENCES.

No. VI.] SATURDAY, DECEMBER 10, 1837. Vol. I.

## BELL-ROCK LIGHTHOUSE.







Holloway Press: D. A. Doudney.

Digitized by Google

## BELL-ROCK LIGHTHOUSE.
ETC.

It has been said of seamen that there is often but a plank between them and eternity; and certainly there is no class of men exposed to greater dangers, and those more frequently, than sailors. They have to contend not only against the elements, when all around them is a barren waste of water, but no sooner are they gladened by the sight of land, than their perils are increased to a much greater extent. In the former case, the wind was perhaps the only danger they might have to provide against; but approaching land, they must take care to avoid the sunken rocks and sand-banks, which otherwise may probably be the cause of their destruction. Our engraving this week represents two means that have been adopted for lessening these evils. The one is a representation of the Bell-rock Lighthouse, and the other of a buoy, a simple piece of apparatus for preventing ships coming upon the sands at Liverpool.

The Bell-rock lighthouse is situate on a reef of rocks, on the eastern coast of Scotland, near Arbroath, in Forfarshire. These rocks had always been particularly dangerous for shipping, and when the commerce of Scotland was very much less than at the time of the erection of the Lighthouse, it is said that the monks of the Abbey of Arbroath erected a bell on the rock, which was rung by machinery, during the flowing and ebbing of the tide, in a manner probably somewhat similar to the buoy described hereafter. About the year 1807, the present noble specimen of what man can accomplish was commenced. An Act of Parliament had previously been obtained for a loan of 25,000l.; and this, with the addition of 20,000l. in the hands of the Board of Commissioners of the Northern Lighthouses, was the sum with which the erection of the Lighthouse commenced. The ultimate expense, however, amounted to upwards of 60,000l. The work was completed in 1810 under the direction of Mr. Stevenson, and reflects the highest honour upon his professional skill. The difficulties that had to be overcome were of a most embarressing description. At the commencement of the work, in consequence of the short time the rock was not covered with water, two or three hours were considered a good tide's work; and frequently, after a portion of the foundation had been completed, a sudden storm would render it necessary to perform the same labour twice over, and even oftener. On one occasion, Mr. Stevenson and the men with him at work, were exposed to great danger, in consequence of the vessel that used to convey them from the rock having broken from her moorings, and the tide at the same time commencing its rise. They were, however, saved by a small boat, which happened fortunately to bring Mr. Stevenson some papers relating to the Lighthouse at the time.

From the engraving, our readers will be able to understand the form of the Lighthouse. The lower courses of stones are trenailed, and wedged together with oak timber, to the height of upwards of forty feet, or throughout the solid part of the building. At the stone staircase, leading from the door to the first floor, the walls are of the medium thickness of about seven feet; this thickness gradually diminishes upwards, till, under the cornice of the building, it extends only to eighteen inches. The stones of the walls of the several apartments are connected at the ends with dove-tailed joints instead of square joggles, as in the solid and in the staircase. The floors are constructed in a manner which adds much to the bond or union of the fabric. Instead of being arched, which would have given a tendency or pressure outwards, on the walls, the floors are formed of long stones radiating from the centre of the respective apartments, and at the same time forming a course of the outward wall of the building, these floor-stones are also joggled sideways, and, upon the whole, form a complete girth at each storey. In this manner the pressure of the floors upon the walls is rendered perpendicular, while the side joggles resemble the grove and feather in carpentry. In the stranger's room, or library, the roof takes an arched form, but the curve is cut only upon the interior ends of the stones of the cornice, the several courses of which it is composed being all laid upon level beds. Formerly the communication between the door of the Lighthouse and the rock, a height of about 30 feet, was by means

Digitized by Google

of a rope ladder. A number of brass stairs now form the means for obtaining access.

In order to give a slight idea of the force this Lighthous has to withstand, we may quote the following remarks by Mr. Stevenson:—He says, "It is awfully grand, at the time of high water, to observe the sprays rising on the building, and even to be on the rock at low water, when the waves are about to break. Being in a manner only a few yards distant, they approach as if they were about to overwhelm us altogether. But now that we are accustomed to such scenes we think little of it. You will, perhaps, form a better idea of the force of the sea during these gales, when I relate to you, that, on the 18th of February, the large piece of lead that was used as the back-weight of the balance-crane, weighing 4cwt. 3qrs. 17lbs, or nearly a quarter of a ton, was fairly lifted by the sea, and carried to the distance of six feet from the hole in which it had laid since the month of August. It was found turned round, with the ring bolt downwards, and it was with great difficulty that four of us could muster strength enough to return it to its former shelf in the rock."

The other part of our engraving represents a very ingenious plan for giving warning to ships when they are approaching too near the sand-banks in New Channel, Liverpool. The apparatus consists of an iron boat, from the centre of which a mast rises, and at the top of it is affixed a piece of metal like a bell; on each side of this are two pieces of iron, easily moveable, which are kept in their places by a spring. When the waves cause the boat to rise and fall, motion is given to the two pieces of iron, which consequently strike against the bell. By this means, as the boat is always in motion, there is a continual noise from the striking of the iron on the bell, and the pilots are thus warned when they are running into danger.

## RAILWAYS.

NO. I.

In a great manufacturing or commercial nation, the transport of goods from one part of the country to another, is a subject of such vital importance, that the construction of turnpike-roads and canals has always engaged, more or less, the attention of the legislative assembly of all civilized nations. The turnpike-road is not particularly confined to any level, and therefore can traverse the country in all directions, nearly on a level with the adjoining land; but considerable skill is required on the part of the engineer who constructs them. Canals have now engaged the attention of scientific engineers for about 200 years, and have therefore been brought to considerable perfection. They are important on account of their being able to convey heavy goods, with a small power, at a cheap rate, where time is of little importance; but from the rate of travelling not exceeding 2 or 2½ miles per hour, and their route being so very circuitous, they are not at all applicable for carrying passengers. The well-known hydrostatic principle, of water always finding its own level, renders it necessary that a canal should be upon as near a level as it possibly can be; but where it is necessary to change the level, it is done by means of a lock; and where a ridge of high land cuts the intended course of the canal, and the ground on each side is nearly on the same level, tunnelling is had recourse to. The name of the immortal Brindley is justly recorded as the first engineer who executed a tunnel in this country: it was on the Duke of Bridgewater's Canal, from Worsley to Manchester. A canal, however, is not only confined to nearly a level, but it must also be the lowest level, otherwise there would be a deficiency of water to float the boats navigating on it.

The introduction of railways for the transport of passengers and goods is of comparatively recent date. Their principal feature is, that the tonnage of the canal can be carried with a less power on them; and by the assistance of the locomotive engine, with very great rapidity. Like the canal the railway is confined to as near a level as possible; but this happens from different causes. The retarding forces to a carriage travelling on a road are the friction of the axles, and the obstacles the wheels have to pass over. The latter is reduced to a mere fraction upon our improved railways; and the friction of the axles on

Digitized by Google

them the principal force that has to be overcome.

Now it has been ascertained that the force necessary to cause 1 ton weight to travel on a railway is 8 lbs., as I will prove on another occasion. The same retardation would be occasioned, or the same force would be necessary to cause the same weight to travel up an inclined plane that rose 1 foot in 280. Supposing the resistance, occasioned by friction, to be removed; or, in other words, the resistance occasioned by the ascent of a carriage up an inclined plane rising 1 foot in 280, it would be just double that with which it would travel on a level; for, according to the law of mechanics, the force necessary to cause a body to travel up an inclined plane, is in proportion as the height of the plane is to its length; and so is the power to the weight. 8lbs., or $\frac{1}{280}$ part of a ton, therefore, being the resistance occasioned by 1 ton on a level, an aditional 8 lbs., or $\frac{1}{280}$ part of a ton, would be occasioned by an ascent of 1 foot in 280. Thus we see that the ascent of 1 foot in 280 would double the power necessary: the $\frac{1}{280}$ of 1 mile would be 19 feet; from which we see that a small inclined plane will materially augment the resistance.

In my next I shall describe the method of examining a country through which it is intended to form a railway.

E. F. W.

## ATMOS THE GIANT.

NO. III.

*Atmos employed as a Miner.*

We have now to contemplate our hero in a new capacity; occasioned, perhaps, by his remarkable success and exemplary conduct in his former situation. One deeply skilled in the occult sciences, an Englishman, was continually, though agreeably, disturbed by the apparitions of the giant, who would let him have no rest; till at last, overcome by his importunate entreaties, he resolved to hazard the worst, and hear what this eager petitioner had to say for himself. So, summoning all the resolution he was master of to his assistance, he made use of the spell, obedient to which Atmos appeared, but in such a form as to make the magician quake for fear, although Atmos, by his conversation, clearly evinced his willingness to serve him. The fact was, the apparatus he had used, and the plans he employed to ascertain correctly the giant's feelings on the subject, were of such a daring description as had never been called in requisition before. The apparatus, &c., we shall first attempt briefly to describe, as well as the principles on which he proceeded in his new and hazardous enterprize. Those principles were as follows:—He was aware of the existence of an elder brother of Atmos, likewise of the peculiarities of this personage; and as he had clearly ascertained our hero's strong filial attachment, he had determined to take advantage of these facts; and he accordingly did so in the following manner:

He constructed a round tower, fitted exactly with a large plug, which was capable of being moved up and down withinside it. Into this tower, and near the bottom, there opened a dark passage, provided with a door. Now this passage also communicated with the vessel in which Atmos, on the using of the spell, made his first appearance; and it was so arranged that Atmos was to run along the said passage into the said tower; and then, according to the power of expansion which he possessed, with all his might and main, to apply his huge shoulders and lift the said plug (then near the bottom) to the summit of the aforesaid round tower. His mother, it was arranged, was then to enter at a door opposite to that through which Atmos had entered; and he (*a dutifullissimus affectionatissimus* son), as the magician very well knew, would immediately rush to render his aged parent every assistance (as, poor thing, she was everlastingly afflicted with a sad cold). But by an invariable law, ordained by Nature herself, it always happened that whenever the son came within the influence of the frigid atmosphere of the mother, whether from profound respect, or by what other means I do not pretend to say, he invariably lost that voluminous bulk which otherwise so eminently distinguished him, and sunk to her comparitively pigmy stature. Upon this happening, his brother, who was known to be very ambitious, would endeavour to

Digitized by Google

gain admission at the top (every other aperture of course being closed to occupy the space which, by the sudden contraction of Atmos, had been left void; and in his eagerness to attain his object, would blunder against the plug, now at the top, and, by the pressure of his enormous carcase, would not fail to seat it very comfortably in its original position at the bottom of the tower. Now it is sufficiently obvious that every time this *truly romantic* scene was repeated the same effects would be produced, according to the peculiarities of this *truly romantic* family. Now, although, as we have long ago stated, the magician was much alarmed at the appearance of Atmos, yet, being fixed in his resolution, he firmly stood his ground, and was eventually very much pleased with the performance; and having thus ascertained the capabilities of this new combination, he next resolved to turn it to his advantage; and after cogitating very much on the subject, determined to aply it to the purpose of mining, in which department of the resources of our country it was very much wanted; and this he effected by connecting the plug with the apparatus of an immense pump, which was employed in clearing the water which so much impeded the progress of the miners in their work; and I can assure my readers that Atmos lost nothing of his former celebrity in his new occupation; his performances, on the contrary, were considered as a perfect miracle of the power of magic, and the curious were flocking from all parts to witness them; and those who beheld were constrained, in a state of utter astonishment to exclaim, "Wonders will never cease!"

YOUNGSTER.

### THE SLIDE OF ALPNACH.

THE following is the substance of a lecture delivered some time ago by Professor Playfair, to his Natural Philosophy class, at the University of Edinburgh, on his return from a Continental tour, during which he had witnessed the extraordinary mode of conveyance, described hereafter, while in full operation.

On the south side of Pilatus, a considerable mountain near Lucerne, are great forests of spruce-fir, consisting of the finest timber, but in a situation which the height, the steepness, and the ruggedness of the ground, seemed to render inaccessible. These forests, which had rarely been visited but by the chamois hunters, are in the Canton of Underwalden, one of those in which the ancient spirit of the Swiss republic is the best preserved; where the manners are extremely simple, and the occupations mostly agricultural; where there are no manufactures, little accumulation of capital, and no commercial enterprize. In the possession of such masters, the lofty firs of Pilatus were likely to remain long the ornaments of their native mountain. Several years ago, however, Mr. Rupp, a native of Wirtemburg, and a skilful engineer, conceived the bold and ingenious project of bringing down the trees by no other force than their own weight, into the Lake of Lucerne, an arm, or gulf of which fortunately approaches quite near to the bottom of the mountain, and from whence the conveyance to the German Ocean was easy and expeditious. Mr. Rupp's plan was to construct a road, along which the trees should glide of themselves into the lake. And to cover the expense of this undertaking he had little difficulty, from the great reputation he enjoyed as a skilful engineer, in forming, from among the capitalists of Switzerland a joint stock company, by which a capital of 10,000*l.* (the sum deemed necessary for the purchase of the forest and construction of the rail-road) was soon subscribed. The distance which the trees had to be conveyed was about three Swiss leagues, or little more than eight English miles. The height of the mountain, according to General Pfyffer's model of the Alps, is 2,500 Swiss feet; but the route by which the trees descended was very circuitous. Along this line the trees descended in a sort of trough, built in a cradle form, the bottom of which consisted of three trees, squared, and laid side by side; the two sides were formed in the same manner; and a rill of water was here and there admitted to moisten the bottom of the trough, and thus diminish the friction, and also prevent the track taking fire. In general the trough is from five to six feet wide at top, and from three to four in depth; but where the trough has a turning, its sides, especially the convex side, are made higher and stronger, to prevent the trees jolting out. Before a tree is placed in the trough the branches are lopped off, and it is also stripped of the bark, which leaves the surface tolerably smooth. When thus prepared, the root end of the tree is placed foremost in the trough, the descent at once commences, and in a few seconds the tree acquires such a velocity as enables it to reach the

Digitized by Google

lake in the short space of six minutes: a result altogether astonishing, when it is considered that the distance is more than eight miles; that the average declivity is but one foot in seventeen, and that the route which the trees have to follow is often circuitous. Along the slide, at equal distances of about a mile apart, are stationed men with large boards, which they use as telegraphs; and the starting of a tree from the top is made known at the bottom by this means almost instantaneously. Also when the tree arrives at the bottom, and is properly deposited, so as to leave room for the next, the information is speedily conveyed to the top, and another tree is started as before. The same process is repeated till the trees that have been got in readiness for that day have been all sent down into the lake. They are there formed into rafts, and floated down the very rapid stream of the Reuss, by which the lake discharges its water—first into the Aar, and then into the Rhine.

By this means the trees sometimes reach Basle in a few days after they have left Lucerne, and there the immediate concern of the Alpnach company terminates.

They still continue to be navigated down the Rhine, in rafts, to Holland, and are afloat in the German Ocean in less than a month after having descended from the side of the Palatus, a very inland mountain, not less than a thousand miles distant.

## ON WARMING ROOMS.

### LONG ROOM, CUSTOM HOUSE.

THERE are no persons on earth, we believe, who make so much noise about being kept warm and comfortable as Englishmen; and yet we think few countries can be found where less care is taken to warm dwelling houses properly than in England. In consequence of the universal custom of having the front of the fire-place open, and every part about it coloured black, we think we may venture to say, that more than half the heat which might be derived from the quantity of coals consumed is entirely lost. No advantage is derived from the heat given out by the sides and back of the grate; and the sides of the hobs being coloured black, they absorb heat, instead of reflecting it, as they might be made to do, if science had any part in the construction of fire-places. In colder countries than ours, and where coal and wood are not so plentiful, the people are more economical of heat. In Russia the rooms are warmed by stoves placed in the middle of the room, somewhat similar to those which are called German stoves; and the consequence is, that much more heat is obtained by the combustion of very little fuel. It has for some time been customary amongst us to warm large buildings by means of hot air, hot water-pipes, &c., and we hope that the practice may soon be adopted in private houses also. In reading over the papers a few days since, however, we met with a statement in the *Morning Advertiser*, which might deter many persons from adopting this plan, unless it can be shown that the deleterious effects of hot air, described in the paper, can be removed. The account was to the effect that several of the clerks who sit in the long room in the Custom House, had, for a long time, occasionally suffered from precisely similar complaints; such as dispepsia, and determination of blood to the head. The similarity of these complaints in nearly 200 different persons, escaped notice for a longer time than could have been expected: but at last so many gentlemen were taken ill, that the attention of the Commissioners was drawn to the subject, and "An inquiry was instituted, consequent on which Dr. Ure was authorised to examine the apartment, the mode in which it was heated, ventilated, and lighted. That gentleman has made a report, which certainly is of a most startling character. He states, that the mode of heating the room, in conjunction with the ventilation, is of so obnoxious a description, that there is perpetually an atmosphere in it as pestilential in its *quality* as the wind after it is carried over the burning sands of the desert; that, in short, the air breathed by these unfortunate gentlemen is the same in quality as the *simoon*; and it is probably because it is not the same in *quantity* that there is any thing like an immunity from the fell results which often follow the inhaling of the poisoned air of the east by the wretched traveller. Dr. Ure points out a mode of escape. He condemns keeping up low fires, in order to ensure an equable heat and ventilation, and rather recommends large fires and brisk ventilation for a short time as more conducive to a healthful atmosphere."

Now, although the plan recommended by the Doctor will, no doubt, be efficacious, if properly acted upon, yet the increased expence will be an objection to it. We think a more simple, and at the same time a more effectual remedy, would be, to have a little water placed in an open metal vessel upon the stove; the vapour generated by this means would quite

Digitized by Google

remove, we think, the pernicious effects of the air being too dry and hot, and render it both healthful and agreeable. We have read an account somewhere of this plan having been effectual, and no doubt it would prove so.

## ON FINDING THE HEIGHTS OF OBJECTS BY MEANS OF THEIR SHADOWS.

*To the Editor of the Penny Mechanic.*

SIR,—If you should consider the following article worthy of insertion in your cheap and useful little periodical, it is at your service.

Independant of trigonometry, there are several methods of ascertaining the altitude of accessible objects. But trigonometry is, undoubtedly, most in requisition; not only on account of its superior accuracy, but also in regard to its general application to all the purposes of ascertaining heights, accessible or inaccessible, distances, &c.; to the latter of which the subject of this paper is not applicable. Euclid demonstrates, that equiangular triangles are similar, or have their like sides proportional, from which property is deduced the method of ascertaining the altitude of any accessible object by means of its shadow: for if a perpendicular be erected on an horizontal plane, it will, in a clear day, when the sun is not vertical, cast a shadow to a given distance; and at the same time, any other high object, situate in the same plane, whether inclined or horizontal, will necessarily do the same. If straight lines be drawn, or conceived to be drawn, from the top of these objects to the extremities of the shadows, it is evident that, unless they are very distant, two similar triangles will be formed, having their sides proportional. In the annexed diagram, let DE be any

perpendicular staff or gnomon, situate in the same plane as the accessible object A B, whose height is required. It is evident that the angles A C B, and D E F are equiangular; for the angles B and E are right angles, and the angles A C B, and D F E, are also equal, each being equal to the angle of the sun's elevation above the horizon; and consequently equiangular triangles, having their sides proportional, it is F E : E D :: C B : B A, which is the rule. Now suppose the length of the shadow of the gnomon to be made the radius with which an arc of a circle is described, commencing at the bottom of the gnomon, and measuring the angle between the horizon line and the line from the extremity of the shadow to the top of the gnomon, the gnomon will then become, by the principles of geometry, a tangent to the circle: whence the former proportion becomes, as the radius is to the tangent of the angle of elevation, so is the length of the shadow of the object to its height, which is a trigonometrical method. But supposing the height of the object was required, and no instrument at hand to measure the angle, it becomes somewhat impracticable, or, at least, abstruse and difficult; whence the first theorem may be with safety resorted to; as, for example,—

F E : E D :: C B : B A.

And assuming the height E D of the gnomon to be 5 feet; and F E, the shadow, 10; and C B, the shadow of the object, equal to 30, the height, B A may be thus found:—

F E : E D :: C B : B A
10 : 5 :: 30 : 15
5

10)150

15

which will be the height of B A and may be expressed in words as follows:—As the length of the shadow of the gnomon is to the height of the gnomon itself, so is the length of the shadow of the object to the height of the object itself.

Space not admitting, I have omitted all geometrical demonstrations, and advanced only the deduced rules, which I trust may be of service, or, at least, amusement to your readers.

I am your obedient servant,
J. L.

## METEOROLOGY.

On the 25th of November last, Dr. Birkbeck, the President of the London Mechanics' Institution, delivered a very interesting lecture before its members, on the above subject. He commenced by describing some of the ancient opinions respecting the atmosphere. It was once thought to extend to the moon, and was believed to be a pestilential congregation of vapours. The true nature and constitution of air might, however, now be considered as pretty accurately ascertained. Some of its constituents were variable, but out of 100 parts about 79 would be found to be azote, and 21 oxygen. There was also about 1 per cent. of carbonic acid, and a small quantity of water, in a peculiar state, besides that which was constantly arising from evaporation. The Lecturer observed, that we were all of us naturally meteorologists to a certain extent; every body took an interest in the weather. He then stated he should proceed to

Digitized by Google

describe the changes it was liable to from the different condition of the air, with respect to temperature,—moisture and the winds. The first was the most important. The air might be divided into two regions, the one that of expansion, or that portion above the equator; and the other that of contraction, comprising the air about the north and south poles. In the former region the atmosphere received considerable heat from the direct rays of the sun, and consequently became lighter than those portions more to the north and south, which only received the sun's rays obliquely. A current of air was therefore continually flowing from the north and south poles towards the equator; and this, with the motion of the earth, produced what was termed the trade winds. The heat of the air depended also on its height above the earth. General Ray had calculated that for every 280 feet above the earth the air became $1^0$ colder. Hence, at a certain height, in all latitudes, there was a region of perpetual snow. About the equator this part was situated higher than in other portions of the earth. It had been termed by Humboldt the "Ico thermo line;" and he had proposed six "divisions of temperature" for describing climate, instead of calculating it according to the situation of the part with reference to the equator. The Lecturer illustrated this part of his subject by diagrams, which explained very satisfactorily any difficulty that might exist from merely hearing the description. By the assistance of a barometer the weight of the air was also demonstrated, and the cause of evaporation was then described. Water was converted into vapour at different temperatures, and in that state was received into the atmosphere. It did not, however, form a chemical combination with the air. It was merely held in solution, and when the air was deprived of a portion of its heat, the vapour was deposited in the form of rain or dew. The Lecturer showed, by experiment, that when air, under the receiver of an air-pump was partially exhausted, a dew was formed on the inside of the receiver, in consequence of the capacity of the air for containing aqueous vapour having been diminished. A very beautiful piece of apparatus for measuring the quantity of dew deposited, was described by the Lecturer, as were also several other means for effecting the same object. The most simple was that of Dr. Dalton, which consisted in noting the quantity of dew formed on the outside of a vessel containing water below the temperature of the atmosphere. The Lecturer then described the effects produced by the wind; although very inconsistent in this country, it was very different within the tropics, where, if a person wished to adduce a natural phenomenon as a simile for constancy, he would most probably choose the wind. The Doctor observed, that however changeable and uncertain the weather might appear to us in this country, he felt convinced its changes were regulated by general laws, which it only required observation to discover. It had been stated by some meteorologists that a repetition of the same weather occurred every eighteen years; and it appeared that an autumn, remarkable for changes very similar to those of the present, had occurred at that distance of time. It required more extensive observations, however, than had yet been made; and he trusted, as a Society for the study of the science had lately been revived, that the laws of the weather would soon become better known.

---

A *Conversazione* was held on the 2nd of Dec. to celebrate the 13th anniversary. The rooms of the Institution were appropriated to the exhibition of some interesting specimens of the works of nature and art; and in the theatre Dr. Birkbeck delivered an address. The music class also lent its assistance, and some songs were sung in excellent style by the Misses Flower and Messrs. Purday and Ball. Messrs. Tucker, Edwards, and Brown, also recited poetry on different subjects; and the members appeared much pleased with the entertainment that had been prepared for them. Much praise is due to the gentlemen of the Committee who managed the business.

---

*Query.*—A Correspondent, "Senrab," wishes to be informed of two or three cheap works on *Brewing*, written in a popular style.

[A very excellent treatise on the subject forms a Number of the "Library of Useful Knowledge," price 6d. "Cobbett's Cottage Economy," price 2s. 6d., also contains useful information relating to the Brewing of Beer.]

---

# INSTITUTIONS.

## LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday, Dec. 12, at seven o'clock, W. T. Brande, Esq., on Chemistry. Thursday afternoon, Dec. 15, at one, W. Chalklen, Esq., on Taste.

*Aldersgate-street Institution*—Wednesday, Dec. 11, T. J. Serle, Esq., on the Construction of a Drama.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Feb. 14, C. Pemberton, Esq., on Elocution.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge-road.—Tuesday evening, Dec. 13, at half-past eight o'clock, Basil Montague, Esq., on the Influence of Science.

*Islington Literary and Scientific Society.*—Thursday, Dec. 15, at eight o'clock, Dr. Trueman, on Respiration.

*Eastern Literary and Scientific Institution*, 88, Hackney-road.—Tuesday, Dec. 6, G. S. Sacket, Esq., on Astronomy.

*Mutual Instruction Society*, Great Tower-street.—Monday, Dec. 12, at eight o'clock, Mr. W. N. Coupland, on Planetary Motion.

*Mutual Instruction Society*, Southampton Coffee-House, Chancery-lane, Thursday, Dec. 8, at half-past eight, Essay on Phrenological Fallacies.

---

## TO CORRESPONDENTS.

We are sorry we must decline to enter into the arrangement proposed by "An Assistant to a Lecturer on Chemistry."

"Mr. Rough's communication shall meet with due attention, but we cannot promise to insert an article until we have perused it.

"J. R. E." The waste steam may be made serviceable for the purpose required after it is condensed into water. The pipes should be iron, rough on the outside, and coloured black.

Thanks to "J. F. P." We are afraid, however, we shall not be able to find room for his letter, as we have several more on the same subject.

"The Differential Striking Clock" requires further explanation.

We are sorry we have been obliged to omit "School of Design" this week. It shall be inserted in our next.

*Scientific Library.*—A Correspondent wishes to know if any of our readers can inform him where there is a good Library of *Scientific* Books in the neighbourhood of the City, from which he may obtain a book or two occasionally without becoming a subscriber.

As this Magazine is stereotyped, any of the back Numbers can be had at the Publisher's.

---

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

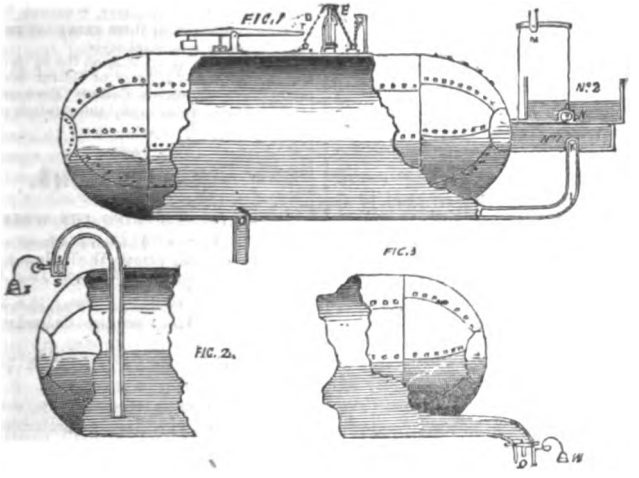
Digitized by Google

# THE PENNY MECHANIC,

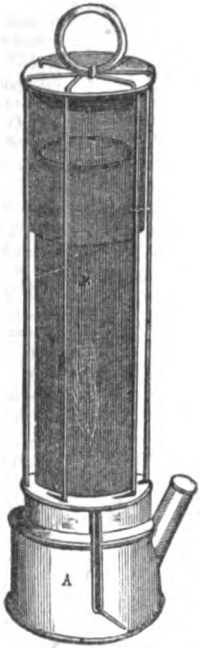
A MAGAZINE OF THE ARTS AND SCIENCES.

No. VII.] SATURDAY, DEC. 17, 1836. Vol. I.

## DOUGLAS'S STEAM BOILER.




## THE DAVY LAMP.




NO. VII.—VOL. I.

Holloway Press: D. A. Doudney.

Digitized by Google

### STEAM BOILERS.

THE improvements made in the machinery of the steam engine by Watt were so complete, and so well adapted to effect all that could possibly be desired, that it has for a long time been the opinion of scientific men, that the boiler in which the steam is generated, is the only portion of the engine in which we may expect any material improvements to be effected. However superior the boilers at present used may be to thôse formely employed, there is still ample room for improvement. The results which attend the bursting of a boiler are so terrific, that we need not be surprised at the number of patents that have been, and are continually being taken out, for the purpose of providing against the possibility of such accidents. We give this week an engraving of a very ingenious piece of apparatus that has been lately invented for this purpose, by Mr. Douglas, of Great Ormand-street, London. Most of our readers are probably aware, that all boilers are provided with what are termed safety valves. These open outwards, and are kept down, or loaded as it is termed, by a weight capable of resisting a certain pressure from the steam within: when this pressure is much increased, it of course counteracts the effect of the weight, and raises the valve, by which means the steam can escape without bursting the boiler. It happens sometimes, however, that the valve becomes fixed, or is prevented rising by some obstacle, in which case the steam will acquire so great an explosive force, that the boiler will burst. Mr. Douglas's invention, we think, is calculated to lessen, if not to remove, the danger entirely. His description of it is as follows:—

Fig. 1, is the side elevation of a boiler in which it is intended to generate and employ low-pressure steam, with his improvements attached; part of this boiler is represented open or enclosed, in order that the improvements may be more distinctly exhibited by the drawing.

Fig. 2, is the end of a boiler in which it is intended to generate and employ steam of a high-pressure, with part of the improvements attached. And

Fig. 3, is also the end of a high-pressure steam-boiler, with that part of his improvements shown in fig. 2, attached to it. This last arrangement, fig. 3, being merely exhibited here to show how the situation of the bell B, and the valve C, may be altered for purposes of convenience. The improvements may be said to consist of two distinct arrangements for insuring safety to boilers, generators, caldrons, stills, or other vessels subject to changes of pressure, whether external or internal, by increase or decrease of temperature or otherwise. When it is wished to guard such vessels against too great an increase of internal pressure, improvements shown at A, (fig. 1,) are applied in such manner that they shall insure the opening of a safety-valve of the usual description, by acting upon the lever or other part of the usual safety-valve arrangements shown at B (fig. 1). The Patentee constructs a small cylinder above the point A, or other convenient part of the said vessel, and fits into the cylinder a piston. As the piston rod C, (fig. 1, ) rises and falls in the small cylinder by the increase or decrease of pressure within the vessel, it is made to vibrate upon the chains D, E, (fig. 1). Connected with the chain F, will be seen a small stealyard, spring balance, or other well-known indicator of pressure, G, suspended from the fixed bracket F. When the piston rod C, ascends this chain E, is acted upon, and the index hand of the spring balance G, will (in this particular arrangement) be seen to have moved downwards. When the piston rod C descends, the pull upon the chain E, is lessened, and the index hand of the spring balance G, will (in this particular arrangement) be moved upwards. The chain D, is operated upon by the rise and fall of the piston rod C. One end of the chain D, is passed through a hole in the end of the safety-valve lever at T, in such manner that it shall have a little play without disturbing the safety-valve by every fluctuation and variation of pressure which may effect the piston rod C, and the indicator G. But if the pressure should continue to increase, and should the safety-valve at B, not blow open, the ascending motion of the piston rod C, will very soon cause the chain D, to pull upon the safety-valve lever and cause (or contribute to cause) the opening of the safety-valve. The improvements described above, or modification of them, Mr. Douglas considers applicable as the means of greater safety, where the causes of boilers or other vessels bursting are such as are generally acknowledged. But as he has from long experience and observation been led to believe that some explosions are attributable to other causes, he has provided for such pecullar causes by the apparatus

Digitized by Google

shown on fig. 1, H, I, K, L, M, N, and O, for low-pressure boilers and other vessels. And by the apparatus shown on fig. 2, P, Q, or by the apparatus shown on fig. 3, R, S, for high-pressure boilers or other vessels. These latter cases of explosion he attributes to the water or other liquid being raised up from the bottom of the boiler, by the rapid formation of elastic vapour which cannot with sufficient rapidity pass up through to the surface of the liquid; such an elastic vapour being a bad conductor of heat becomes more highly charged with heat, and with the more power repels and drives upwards the liquid, forcing the steam off by the valve, and sometimes the water also. When in such cases the valve is shut, the deflected forces cause a showering of the upper and cooler liquid amongst the lower or hotter elastic vapour, by which this hotter elastic vapour is condensed or partially condensed, and the pressure is thus suddenly reduced below the pressure of the atmosphere. He therefore provides the low-pressure boiler with a supply of water ready to rush in below when this reduction of pressure takes place in the inside, as at fig 1, and he provides the high-pressure boiler with a supply of atmospheric air to rush in as at figs. 2 and 3. In low-pressure boilers is used the arrangement of cisterns (fig. 1), when the internal pressure is too little, and a collapse likely to happen, the hanging valve K, will be pressed open by atmospheric pressure, and water from the cistern No. 1, will flow into the boiler along K, I, H, For keeping No. 1, well supplied with water, he uses the common float apparatus L, M, by which means water is permitted to flow down N, from No. 2, when required in No. 1. In some situations, and particularly in steam-boats, a mere pipe and valve O, from the bottom of the boiler into the water will answer the same purpose for either high or low-pressure, and may then be better than the cisterns No. 1 and No. 2. In high-pressure boilers the Patentee prefers using the arrangement of a pipe and valve with signal bell, shown in fig. 2, and air is pressed in through the valve Q, and through the pipe P, when necessary to prevent a collapse. The signal bell W, is intended to warn the engineer that such change has taken place. In some situations it is better for the air-pipe valve and bell to be arranged as on fig. 3, at R, S, X.

## THE DAVY LAMP.

If we were requested to point out an example of what science has done for man, there is none to which we should refer with greater satisfaction than to the Safety Lamp, invented by Sir Humphrey Davy, for the purpose of preventing the explosion of inflammable gases in mines. This little instrument, of which an engraving is given in our front page, has, perhaps, been the means of saving more lives than any other whatever. Before it was introduced into our coal-mines there was no certain security for the miner against a frightful death, except he worked in the dark. As this however could not be done, explosions were constantly occurring, generally attended with the loss of many lives. These accidents at last took place so frequently, and, in consequence of its being impossible to work in the mines at all, except under peculiar circumstances, the value of mining property was becoming so much depreciated, that a number of gentlemen formed themselves into a society for the purpose of discovering, if possible, some means of remedying the evil, They applied to Sir Humphrey Davy, and he, after performing a variety of most ingenious experiments, produced the Safety Lamp. We must defer till a future Number a description of the beautiful specimen of inductive reasoning which the discovery of the Safety Lamp affords, and at present, simply describe the lamp itself. It is indeed merely a common lamp, inclosed in a case of wire gauze, which possesses the property of preventing the passage of flame through it. Any one may prove this for himself, by holding a piece of wire gauze over the flame of a candle, when he will find that the flame does not pass through. In the bottom part of the lamp is contained the oil, which supplies the wick rising in the centre. In most lamps a small reflector is placed behind the wick, and in front of it a lens, for making the light more powerful. A piece of spongy platinum is placed in the wick, and when the flame of the lamp is extinguished by the foul air, this platinum keeps at a red heat, until the miner removes to a less dangerous spot, when the wick is ignited by it, without its being necessary to open the wire gauze. It will thus be seen that the whole merit of the lamp consists in having this protection against the

Digitized by Google

flame communicating with the inflammable gases outside, and in the use of the piece of platinum; yet this simple invention has, perhaps, effected more good than any other that was ever proposed.

## NATURAL PHENOMENA.

### FORMATION OF DEW.

THE appearance of dew is familiar to every person, and is perhaps one of the most beautiful objects for contemplation in nature. In all ages it has been a subject for a poet as well as the naturalist, and few persons indeed can view the dew-drop on the grass, reflecting all the colours of the rainbow, or glittering on the delicate thread of the spider, without being struck by the beauty of its appearance, and wishing to know something of the cause that has produced it.

The importance of dew to the vegetable world, in particular, will perhaps be appreciated, when it is stated, that very many plants derive nearly the whole of their nourishment from the water deposited in this manner. Every plant, indeed, depends on it more or less; and in some countries, where rain very seldom occurs, the inhabitants are indebted to the dew for a great portion of the water they receive. By its formation also the atmosphere is relieved of much of the aqueous vapour it contains, and is thus fitted to perform many important operations that would not otherwise take place,

Dew for a length of time was thought to descend to the earth in the same manner as rain. Not many years ago even Dr. Hutton defined it to be "a thin, light, insensible mist, or rain, ascending with slow motion, and falling while the sun was below the horizon, differing from rain only as it was greater or less in quantity."

From the series of observations made by Dr. Wells, during a period of two years, Dr. Hutton's theory has been proved incorrect. Dew does not descend to the earth as light rain, nor in the same form that we perceive it on the grass or other objects. When first observed, it appears as very small irregularly-shaped flat spots, which gradually increase in size, and joining others, form small globules, to which the term dew-drops is generally applied.

Dew forms more readily, and in greater quantity, on some bodies than it does on others. Vegetables will have dew copiously deposited on them when metallic substances will be entirely free from it. The metals appear, indeed, to be the worst possible substances for the deposition of dew. The process is also only found to take place under certain circumstances. High winds and a cloudy sky will entirely prevent it; while it proceeds most favourably when the sun is below the horizon. A considerable quantity is, however, formed a little after sunrise, and also before sunset.

From a consideration of these circumstances, and after performing a variety of experiments, Dr. Wells has proposed a theory, which is described by Dr. Thomson as "one of the most beautiful examples of inductive reasoning in the English language." It is but fair to state, however, that a writer on the subject, in the Encyclo. Brit., does not consider the conclusions from the experiments so exact as might have been obtained, although he admits their general correctness. The theory will be understood, perhaps, by the following explanation:—

It is a well-known law of heat that it always has a tendency to diffuse itself equally throughout all bodies; and if, therefore, different substances on the surface of the earth cool down to a lower degree of temperature than that of the atmosphere at the time, the latter will part with a portion of its heat to them. Now we stated in the article on Rain (No. I., p. 4) that the air was continually receiving, by evaporation from the water on the earth, a considerable quantity of aqueous vapour, and that when the air was warm it would contain a much greater quantity than when it was of a low temperature. It will, therefore, at once be seen, that if the air be cooled gradually, the vapour will be deposited in like manner; and this is the cause of the formation of dew. Directly the sun descends below the horizon, and a little before this, and for a short time

Digitized by Google

after sunrise, as just stated, different substances on the earth begin to radiate, or give off the heat they have received during the day into space. The atmosphere has its temperature but very little affected by this means; and if the sky is unclouded, and the air still, the body that radiates its heat soon becomes cooler than the atmosphere, which immediately begins to impart to them a portion of its heat. Its temperature is thereby reduced; it can no longer hold the same quantity of vapour in solution that it did previously, and it is then deposited in the form of a dew. The reason it does not form when the nights are cloudy is, because clouds prevent the radiations of heat from the earth. If the wind is high it will also prevent dew being deposited. Perfect stillness of the atmosphere is not absolutely necessary, for the gentle motion of the air, pregnant with moisture, facilitates the disengagement of dew, since fresh parcels of it will be brought more frequently into contact than if the atmosphere were entirely calm; but on any agitation approaching to wind, the deposition ceases.

During spring and autumn dews are most abundant in this country; and it is in these seasons that there are the greatest differences in the temperatures in day and night. The average quantity of dew deposited in this country is estimated at a depth of five inches, being about one-seventh of the mean quantity of moisture supposed to be received from the atmosphere, over all Great Britain, in the year, or about 22,161,337,335 tons, taking the ton at 252 imperial gallons.

When the dew freezes, as it frequently does at this period of the year, it presents the very beautiful appearance termed hoar frost, the forms of which are among some of the most beautiful objects for the microscope.

## THE HUMAN BODY.

SECOND ARTICLE.

In our last paper on this subject, we described the principal means by which the change of structure that is constantly taking place in our bodies, was effected. The *material* out of which this waste is supplied, is the blood, the properties of which we will now bring before the notice of our readers.

Every portion of the body is formed from the blood; whether it be bone or muscle; tendon or skin; the hair on our heads, or the brains within them—these, and every other solid and every fluid in the body, are formed from the blood. This is itself produced from the food we eat, by a process termed digestion, into which we shall not, however, enter at present. The ordinary appearance of blood, as it flows from a wound is familiar to every one. It is red and rather glutinous to the touch. It does not however possess a red colour in all living beings. In insects it is generally colourless: in the caterpillar it is green. In fish it is colourless, excepting at the gills. Some physiologists have in consequence proposed to confine the term blood to that fluid in man alone, but, as all animals have a circulating fluid, agreeing in its principal qualities with that of man, we see no occasion for the distinction. In plants it is termed sap. The colour of the blood has been attributed to various causes. Dr. Prout says, it is in consequence of its containing iron, which becomes oxydized by exposure to the atmosphere in the lungs; and he has calculated, from some experiments performed by him, that the blood in the bodies of forty men contains enough iron to make a ploughshare. Other celebrated chemists have denied that the colour is produced by an oxide of iron, and maintain that it is owing to the presence of a vegetable colouring, which gives a peculiar hue to the blood, as it does to the rose, or to the violet. Colour, however, does not appear to have any very great influence on the nutritive quality of the blood, since we find that some parts of the body are nourished by that which is colourless. For instance, the cornea, or white part of the eye, is supplied with bloodvessels, and has a circulation constantly going on through it, yet, unless the eye becomes what is termed "blood-shot," there is no appearance of a circulation; still we know that it takes place as certainly in the one case as the other, since no part of the body could remain alive unless it was supplied with blood. If a person views a drop of this fluid through a microscope, he will find that it contains an immense number of small globules. These are the causes of the colour. They have been computed at less than the six thousandth part of an inch in diameter, and we may therefore form some idea of the minuteness of those vessels of the eye that will not admit even such minute bo-

Digitized by Google

dies as these to pass this. They are larger in some animals than they are in man, and are said to be larger in fish than in other living creatures.

Although, as we have stated, every part of the body is formed out of the blood, yet it must not be supposed that it contains bone, muscle, cartilage, &c., as we find them in different parts of the body. It does not contain these, but it contains the elementary substances out of which they are formed. Thus it contains phosphate of lime and albumen, which united together in certain proportions, form bone; and the same with respect to the other solids and fluids of the system.

The quantity of blood in the body of an individual it is almost impossible to ascertain with precision, since it will of course vary according to the quantity of food that is eaten, and a variety of other circumstances, such as the state of activity of the secretary organs, and condition of the digestive powers. From the best calculation that can be made under these circumstances, it appears that an adult, in good health, contains about thirty pounds of blood. With respect to its temperature, we have much better data to reason upon, since it is found to be very nearly the same in men in every part of the earth. The inhabitant of a country on the equator, will be found to possess a temperature but very little exceeding that of persons in England, —and the natives of Greenland, and other parts of the frigid zone, do not materially differ in animal heat from ourselves. The temperatnre of man is found to be about 98°. Some animals are warmer. The duck, for instance, raises the thermometer to 107°.

Although we have spoken of the blood as a fluid in all respects similar, yet there are, indeed, two kinds of blood in the body: the one is termed arterial, and the other venous. The first is of a bright red colour, and is found in the arteries of the body; the other is of a dark purple colour, and circulates through the veins. The cause of this difference in colour will be described when we consider the effects of respiration; it is merely mentioned now to prevent any misunderstanding on the subject; for both venous and arterial blood possess, in common, all the properties we have been describing.

In our next paper on this subject we shall notice the process of coagulation, and the other constituents of the blood not yet mentioned.

*To the Editor of the Penny Mechanic.*

SIR,—In the third Number of THE PENNY MECHANIC there appeared a "Quere" respecting "The cause of the rise of sap in trees, and is it to be accounted for on the principle of capillary attraction?" Having paid attention to this subject, and for the information of those ignorant of the opinion of naturalists, I subjoin the following remarks; which, if you think worthy of a place in your pages it will fully compensate yours, obediently,

*Strand, Nov. 28.* EYTON.

Naturalists have attributed the ascent of sap in vegetables to different causes; some to the action of temperature upon the fluid, which action will cause it to ascend by a diminution of its own gravity; some to the *capillary attraction*. But the most generally-received opinion of the cause of its ascension is, that the sap itself exerts an exciting action upon the irritable fibres of the vessels, and by their contraction the fluid is forced upwards. Nevertheless the sap, in its ascent, varies with the heat and state of the atmosphere as well as the season of the year. During the winter months it is suspended, but on the approach of spring it again commences vigorously, and more particularly at that period, causing the full expansion of the leaf.

De Stales found, by experiment, that by affixing, in a proper manner, glass tubes to a branch of the vine, in the heat of the day, the sap would ascend, or rise in these tubes at the rate of an inch in three months, and attain a height of more than twenty feet; and that the force of the sap upwards would sustain a column of mercury of thirty eight inches, which would require a column of water of more than forty feet. The Doctor further remarks, that this force is five times greater than the blood's force in the canal artery of the horse, seven times that of the like in the dog, and eight times greater than the blood's force in the same artery in the fallow deer.

## SCHOOL OF DESIGN.

WE have received the following communication from a correspondent.

*To the Editor of the Penny Mechanic.*

SIR,—I should be exceedingly obliged if you could give me any information, through the medium of your valuable periodical, (which I think has long been wanted), relative to the time of opening of the new School of Design, the place where it is to be held, and the class of persons for whom it is intended.

I remain your sincere well-wisher

16*th Nov.* 1836. A CITY APPRENTICE.

Digitized by Google

The School of Design mentioned by our correspondent is about to be formed, under the patronage of Government, for the purpose of instructing artisans in a knowledge of the arts connected with our manufactures. The session of Parliament before last, a Committee of the House of Commons was appointed to "inquire into the best means of extending a knowledge of the arts and of the principles of design amongst the people, especially the manufacturing population." From the evidence given before that Committee, and which has lately been published, it appeared that our workmen were much in want of knowledge of the kind mentioned; and in consequence, it is supposed, of this evidence, the Chancellor of the Exchequer, last session, moved the grant of a sum of 1500*l.* for the purpose of establishing a "School of Design." We have not been able to learn when the School is to commence, but directly we do so we shall not fail to notice it. In the mean time the following particulars may be useful; and as they are taken from official documents they may be relied on.

The management of the new school is to be entrusted to a body of persons well informed in the arts, subject to the regulations of the Boards of Trade as to the administration of the grant. The Establishment is to consist of a curator or director, two masters, with one or more attendants.

The duty of the curator will be to select proper objects for the museum, and to submit estimates of the expense to the Board of Trade; to take charge of such objects, whether purchased or presented; and, above all, to give, at stated periods, by way of lecture, instruction on the specimens to the scholars generally, to which lectures the public shall have the right of admission on paying a small fee.

The two masters should be of a different order of attainments, and employed accordingly.

It is proposed to divide the school into four classes, of two of which the iniatory teacher should have the charge, the principal teacher having the charge of the others.

The classes of the initiatory teacher will be,—

1st Of drawing in outline perspective, and drawing-board practice.

2nd. Of the same, with the addition of light and shade.

The classes of the principal teacher will be,—

3rd. Of the above, with the addition of water and body colour.

4th. Of composition and imaginative design generally.

It is supposed that the scholars who will apply for admission in the first instance will draw moderately well, and that of them there will be a sufficient number to make at once a class of each description.

But it may be necessary, in addition to the above provision of two teachers, to provide for the apointment of a lecturer, occasional or otherwise, to give special instruction in the chemistry of colours, as well as other necessary arts.

The school should be supplied with a proper collection of books, with casts of the best ornamental works, and a collection of accurate and well-coloured drawings and prints on botany and zoology.

The best of our own and foreign manufactured articles are also to find a place in the Institution.

By these combined means, with the aid of an annual exhibition, and probably of premiums and nominal rewards to successful scholars, the experiment will have sufficient trial, and the ultimate results upon art may safely be left to the operation of those influences which have hitherto governed the progress of all kind of enterprise in this country.

## MANUFACTURE OF SUGAR.

The sugar cane affords most of the sugar which is consumed in Europe. The ripe canes are crushed between two iron cylinders placed perpendicularly. The expressed juice falls on a plate beneath, whence it flows into a caldron, where it is boiled with wood-ashes and lime, and the scum taken off. This boiling with ashes and lime is repeated in three other boilers, which process converts it into syrup. It is then strongly boiled with lime and alum, and when sufficiently concentrated is poured into hogsheads pierced at the bottom with many holes, to let off the molasses, which will not crystallize. These holes are afterwards stopped with canes, as we see them when the hogsheads are imported. The sugar as it cools, becomes solid in the casks, and is called *Muscovado* sugar. It afterwards undergoes in Europe several refinings in order to form it into loaf sugar.

Oxygen is absolutely necessary for the formation of sugar, which is a vegetable oxide. If it were deprived of the greater part of this oxygen, it would lose its sweetness, and would be no longer sugar,

Digitized by Google

but a singular kind of substance possessing properties more analogous to gum than sugar. Mr. Cruickshank has effected this change on sugar by means of phosphuret of lime, which has a very strong attraction for oxygen; though he was not able to reproduce sugar by the union of gum with oxygen.—*Parks.*

*Effects of Intense Cold.*—In Iceland and some other northen countries, the thermometer frequently falls to zero, which is 32 degrees below the freezing point, At Hudson's Bay it has been known to sink even 50 degrees lower. When stones or metals, which have been exposed to such degrees of cold, are touched by the tongue, or the softer parts of the human body, they absorb the heat from those parts with such rapidity, that the flesh becomes instantly frozen and mortified, and the principle of life in them is extinguished. Some French academicians who made a journey to the northen end of the Baltic, and wintered under the polar circle, found it necessary to use all possible precautions to secure themselves from the dreadful cold which prevailed. They prevented, as much as possible, the entrance of the external air into their apartments: and if at any time they had occasion to open a window or a door, the humidity of their breath, confined in the air of the house, was condensed and frozen into a shower of snow; their lungs, when they ventured to breathe the cold air, felt as if they were torn asunder; and they often heard the rending of the timber around them by the expansive power of the frost on the fluid in its pores.

## INSTITUTIONS.

*London Mechanics' Institution.*—A general quarterly meeting of this Institution was held on Wednesday, 7th December, Dr. Birkbeck in the chair. The Committee presented their Report, by which it appeared that the receipts during the quarter had amounted to upwards of 405*l.*, that 50*l.* had been paid off the building debt, and that 108*l.* 9*s.* 9*d.* remained in hand. During the last twelve months 1949*l.* 10*s.* 10*d.* had been received, and 1851*l.* 1*s.* 1*d.* expended. 221*l.* had been paid to lecturers alone. The number of members at the end of last quarter was 1063: there had been 399 new members elected, and 227 had ceased paying their subscription, the present number was therefore 1249. After the Report had been read a member who had been expelled the Institution for misconduct, by the Committee, appealed against their decison to the members, and after a prolonged discussion was reinstated. An adjournment then took place till Thursday evening, when the members passed a resulution to the effect, that the Committee should not have the power of closing the door of the room in which they met against the members, on any occasion. A future adjournment took place till Saturday, when this resolution was modified, so that it should not be acted upon when the estimates of tradesmen were being discussed. Some motions that were intended for discussion were postponed till next quarterly meeting, and the meeting then adjourned.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus—Monday evening, Dec. 20, at seven o'clock, Dr. Birkbeck on Insects.—Thursday afternoon, Dec. 22, at one, W. Chalklen, Esq., on Taste.

*London Mechanics' Institution*, Southampton-buildings, Chancery lane.—Wednesday, Dec. 21, at half-past eight, Lecture on Juries and Witness,—Friday, Mr. Haydon on the Fine Arts.

*Aldersgate Street Institution.*—Wednesday, Dec. 21, at half-past eight, Robert Adams, Esq., on Cryptogamic Botany.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Dec. 21, C. Pemberton, Esq., on Elocution.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge-road.—Tuesday evening, Dec. 20, at half-past eight o'clock, D. Cooper, Esq., on Cryptogamic Botany.

*Islington Literary and Scientific Society.*—Thursday, Dec. 22, at eight o'clock, Mr. Severn, on Music, with illustrations.

*Eastern Literary and Scientific Institution*, 88, Hackney-road,—Tuesday, Dec. 20. G. S. Sacket, Esq., on Astronomy.

*Mutual Instruction Society*, Great Tower-street.—Monday, Dec. 19, at eight o'clock, Mr. Thomas, on the Steam Engine.

### TO CORRESPONDENTS.

"Mr." King we shall be happy to hear from. Apply at the Society of Arts, Adelphi.

"C. H. S.'s" article we shall find room for shortly if we can.

We did not receive the account of the Meteorological Society in time.

"R. L's." letter should have been addressed "To the Editor." We have no objection to his wish.

Received "J. L.," "Mr. Gorbell," "A. E.," and "J. G."

Communications requiring immediate attention should be sent to the Publisher's by Tuesday afternoon.

Next week we hope to fulfil our promise of giving a view of the opening of the Greenwich Railway, which took place on Wednesday last. Our artist was present on the occasion, and will, we trust, enable us to present our Readers with a very spirited representation of that imposing spectacle.

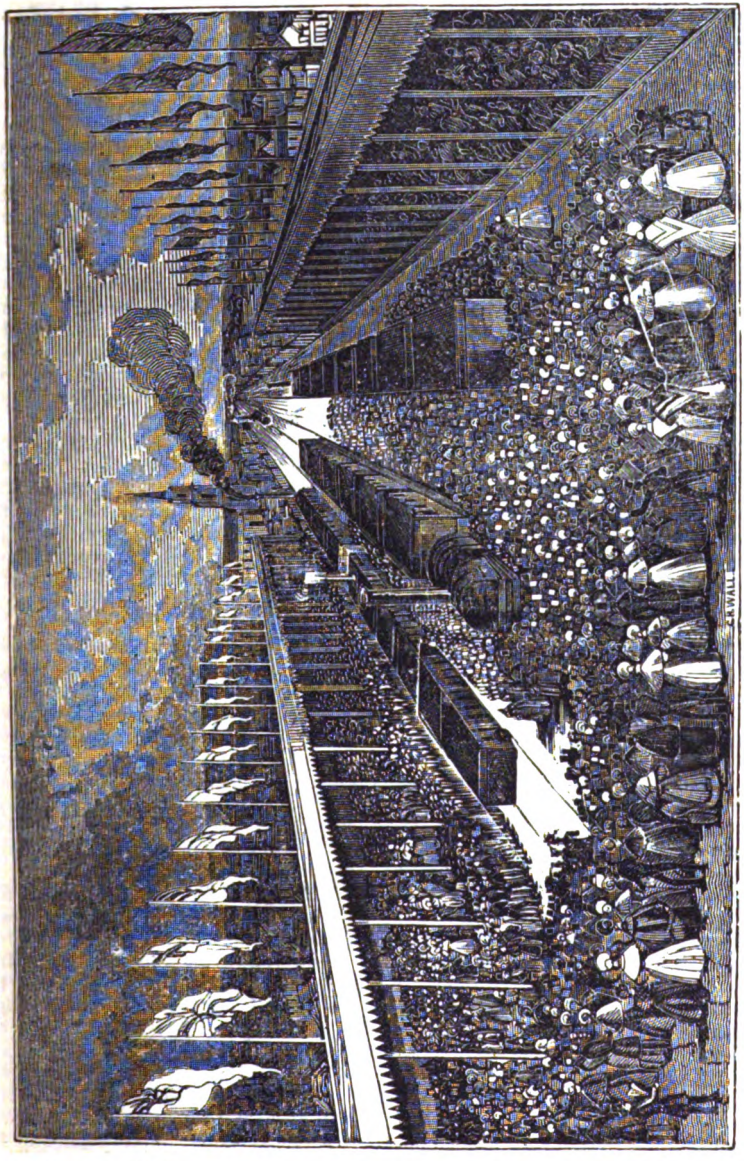
London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Hollywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,

A MAGAZINE OF ARTS AND SCIENCES.

No. VIII.] SATURDAY, DECEMBER 24, 1836. Vol. I.



THE GREENWICH RAILWAY, AS IT APPEARED ON THE 14th INST.



Holloway Press: D. A. Doudney.

Digitized by Google

### THE GREENWICH RAILWAY.

On Wednesday, the 14th instant, this Railway was opened to the public. This event, it was intended, should have taken place on the 1st of November last, but as the iron bridge over Bermondsey-street could not be completed by that time, the ceremony was necessarily postponed. It was our intention to have given an engraving of the Railway as it appeared on the occasion in our first number; but being disappointed, we now redeem our promise. In Number II. will be found a general description of the Railway; the expense of its erection, and various other particulars respecting it. To these we may add, that the number of arches now finished, amounts to 842. When the Railway is completed, there will be above a thousand.

The day appointed for the opening, was as fine as could be desired, and the Lord Mayor having announced his intention of attending in state, an additional interest was given to the ceremony. We must confess, however, that we did not anticipate the number of spectators would have been near so great as it was. In fact every point from whence the Railroad could be seen, was crowded with people. We were glad to notice this because it evinces the interest that is felt in the undertaking; although it made it rather inconvenient for those who had tickets, to gain an entrance to the Railway.

Shortly after one o'clock the Lord Mayor arrived, and was received with much applause. He was attended by the Sheriffs, and other Officers of the City, and after being introduced to the Chairman and Directors of the Company, was escorted to one of the carriages that had been reserved for him and those by whom he was attended. There were, we believe, 44 carriages on the different lines, but these were not half enough to accommodate the company, some of whom found seats in them how they could, and the remainder were obliged to stay behind, when the trains first started. When all was in readiness, the carriage containing his Lordship was set in motion, and proceeded some distance on the line, and then stopped; and the other trains were set off, and passed in review before the first; they were then also stopped, and the Lord Mayor's train again set in motion, and arrived the first at the termination of the Railway at Deptford. Here an address was presented to his Lordship by the Rector of Deptford. in the name of himself and the other parish officers. It thanked him for the countenance and support he had given to the undertaking, and alluded to the advantages that must be derived by the inhabitants of London "from having the means afforded them of visiting, in the short space of five minutes, a place which by reason of its magnificent hospital, romantic park, and picturesque scenery, has long been justly considered the pride of England, and the envy of foreigners." The Lord Mayor in reply stated what we think few persons will be inclined to dispute, namely, that the most important commercial interests are concerned in the undertaking, and that the transit of goods from the Metropolis, independent of the conveyance of passengers, will be of the greatest advantage.

After this part of the ceremony had concluded, his Lordship and party attended by the engineer, Col. Landmann, proceeded to view the portion of the Railway leading on to Greenwich, that at present is in an unfinished state. The company afterwards returned to town, and partook of an excellent collation that had been provided for them at the Bridge Tavern.

Every arrangement had been made to secure the comfort of those who attended the ceremony, but in consequence of the immense number of persons who were present, some little confusion necessarily ensued. We are happy to say, however, that no accident of any kind happened. The bands of the Coldstream and Grenadier Guards were in attendance, and enlivened the company by playing many beautiful pieces of music.

On the whole we think the affair passed off very satisfactorily. The company appeared highly gratified.

Our Engraving represents the Railway at its commencement on the Southwark side of London Bridge. The view is taken from inside the Railway gates, at the time the Lord Mayor and his party had just entered the carriages. We think our readers will agree with us, that the artist (Mr. Wall) has done ample justice to the subject.

Digitized by Google

## PERPETUAL MOTION.

It is said that no man is sane on all subjects; and although, in order to prove the assertion correct, a very queer definition must be given of insanity, still the extraordinary fancies that are occasionally entertained by many highly intellectual men, on particular subjects, certainly show that the assertion may be right to a certain extent. There are some species of monomania with which it seems a person may be affected, without its being known either to himself or to those with whom he is constantly associating. What other reason can we assign to account for the anomaly of Lord Bacon—the author of the *Novum Organon*, and the great teacher of inductive Philosophy—believing in the absurdities of witchcraft? or how can we explain the fact, that such men as Tycho Brahe, the astronomer; and Napier, of Marchesston, the inventor of logarithms, were firm believers in the truth of Judical astrology? What but a species of insanity also can induce such numbers of really intelligent persons—at least as far as the ordinary business of life is concerned, to put their trust in the predictions of "Frances Moore, Physician." However discreditable it may be to the Stationers' Company to publish such a worthless book as Moore's Almanack, it is certain they would not do so unless its sale was sufficient to remunerate them handsomely. We may imagine, therefore, how many must be afflicted with the "almanack monomania."

As we find so much credulity in men of sound sense and judgment on most subjects, we need not be surprised that the idea of a perpetual motion is still entertained by some, although the impossibility of it has been demonstrated over and over again. Disappointment in this case, however, only appears to give fresh energy to make further attempts: and, like the alchymists' idea of the transmutation of the baser metals into gold, and the possibility of discovering an elixir of life, the perpetual motion appears to be a subject that will only finally be given up when the general intelligence of the people is such, that they will be able to comprehend the mode of operation of the simple laws of nature, whether seen in the works of man, or in those of the Creator.

One of the principal arguments against the possibility of a perpetual motion is, that friction, sooner or later, must bring every body set in motion to a state of rest, unless a continually-increasing force is applied. In some cases the truth of this proposition may be said to be self-evident, and requires no proof whatever: in other instances it is not so clear; and hence the various attempts to produce a perpetual motion by such means as water flowing through tubes, &c. Here, however, there is friction to overcome, the same as in a machine, and therefore it is equally certain the same result will in both cases be produced.

The term *perpetual* motion is evidently an illogical expression, since everything will wear out in time, and so must the materials of the engine by which the desired result is hoped to be obtained. No motion can therefore be *perpetual*. But, say the theorists, we only expect to obtain a motion that shall continue until the materials of the engine are worn out. Why, then, a soap bubble, blown by a child from a tobacco pipe, is a perpetual motion, for it will continue rising in the atmosphere until it bursts! Many other instances of a perpetual motion of a similar kind may be adduced, but these would not suffice to show the folly of the idea. We beg therefore to press upon the notice of those who still think the *desideratum* may be obtained, the fact, that no power is *gained* by the use of machinery, it is only concentrated; and we are thereby enabled to employ it more advantageously than we could otherwise. This fact has often been overlooked. Persons have imagined, because by means of a lever or a pulley we can raise a weight twenty times as great as we can without them, that we gain power by using them. This is a mistake. If we can raise twenty times as much by means of a lever as we can without it, we are twenty times *the time* in accomplishing it in the one case to what we should have been in the other. The advantage of power is therefore only obtained at the expense of time.

Digitized by Google

Now it is evident, if all motion is opposed by friction, that unless an engine of any kind possesses the power of generating a constantly - increasing force—a power greater than that which first set it in action—it must in time come to a state of rest. For instance, a ball thrown along the ground will proceed to a certain distance, having its velocity gradually lessened, until at last it stops. This is in consequence of the friction between the ball and the ground; but it is evident, that if the ball in its progress could increase its force, just enough to counterbalance the friction, that it might roll on for ever. This, however, it cannot do, and it therefore necessarily comes to a state of rest. The case of the ball may be applied to any body set in motion; the same forces are constantly operating. The laws of motion are unchangeable; to every action there is an equal reaction. If, in defiance of this law, man could once produce a perpetual motion in a pin, he could accomplish it for a body eqnal to "the great globe itself." It would not be more difficult to accomplish it in the one case than in the other; but in both it is impossible.

From a consideration of these facts, it is evident, that *if friction cannot be prevented*, and if any given force *cannot of itself generate a greater force*,—the impossibility of which is self evident when put in the form of a simple proposition,—that there can never be a perpetual motion. When men construct complex machinery to obtain this, they may, by this means, render it difficult even for a scientific man, to estimate accurately the forces that will be brought into operation when the machinery is set in motion; and from this circumstance many persons have no doubt found it difficult at times to point out why the machinery should fail; but while matter is subject to the laws we have just mentioned, it must be evident, that man can never produce an effect, to continue for ever in opposition to them.

The revolution of the planets affords the principal example of perpetual motion; but as man cannot equal the works of the Creator, even in the construction of the simplest flower, how vain is it to suppose that a human being can produce an effect equal to that - for perpetual motion must be equal to that, which causes the revolution of the planets round the sun, and is the cause of all those mighty changes that result from the return of day and night. summer and winter.

With reference to the query of "an Enquirer," in No. IV., we may observe, that water will never run from a syphon unless one leg of it is longer than another. If our correspondent shortens one leg, however much he may increase its diameter, he will find the water will not flow through it. He will find the *rationale* of this in any treatise on Hydraulics.

## TO FIND THE DIAGONAL OF A SQUARE.

*To the Editor of the* PENNY MECHANIC.

SIR,—In a monthly periodical now publishing by Mr. George Bennett, entitled Geometrical Illustrations, it is shown that the proportion of the diagonal to the side of the square is in a ratio nearly as 17 to 12; and the proportion of the side of the square to the diagonal as 12 to 17. For he shows that if any diagonal line be divided into 17 equal parts, the side of the square inclosing that diagonal will contain 12 of these parts; from which is deduced the above analogy. This theorem may be of some use to practical mechanics to find the diagonal of any square, from having the side given, and *vice versa* the side from having the diagonal given. Although the simplicjty of the numbers scarcely require it, I have placed them in the form of a rule, as follows:—Having the length of any diagonal to find the side of corresponding square:—

Rule.—As 17 : 12 :: length of diagonal to side of square required.

Expl.—17 : 12 :: 17... { assumed length of diagonal.
12

17) 204

12 { lgth. of side required.

Having the length of the side of any square, to find length of corresponding diagonal:—

Digitized by Google

Rule—As 12 : 17 :: side of square to the length of diagonal required.

Expl.—12 : 17 :: 12 {Assumed length of side.
17

12) 204

17 {length of diagonal required.

I remain your sincere well-wisher,
J. L.

### PHOSPHORESCENCE OF THE SEA.

*To the Editor of the Penny Mechanic.*

Mr. Editor—Being in company with a few friends the other evening, a person who had been living by the sea-side mentioned having frequently observed a luminous appearance of that element, and as there are various opinions upon this subject, I shall feel much obliged if you will answer or insert the following Query :—What is the cause of the luminous appearance of the sea, and is it to be accounted for by the power of electricity ?

*Hackney, Dec. 10th,* 1836. J. G.

We shall always have much pleasure in answering the queries of correspondents, when the subject on which they write is likely to prove generally interesting.

The luminous appearance of the sea is no doubt produced by more causes than one. Many fish are endowed with the power of emitting light, in order that they may thereby be enabled to pursue their prey. Flashes of light are frequently seen to dart along a shoal of herrings or pilchards. And the tribes of Medusa can also become phosphorescent at pleasure. These no doubt produce occasionally the particular appearance of the sea mentioned by our correspondent; but it is not entirely to be attributed to the light omitted by certain kinds of fish, or marine animalcula since it has been observedin water in which no living creatures could be found; and many scientific men are therefore inclined to consider that it may be the result of some compound of phosphorus, arising probably from the decomposition of dead fish, and suddenly evolved and spread over the surface of the sea. The salts of sea-water, muriate of soda, and sulphate of magnesia, combined with some of the secretions of fishes, also no doubt produce the luminous appearance. We should be inclined to attribute it to these causes rather than to electricity; indeed we know of no facts that would induce us to consider the latter concerned in the production of this phenomenon.

## MECHANICS' LIBRARY.

### LECTURES ON THE STEAM ENGINE, BY DR. LARDNER. A New Edition.

Few men have done more to make scientific knowledge generally understood by the great body of the people, than Dr. Lardner. Uniting with extensive knowledge, a most agreeable manner of imparting it to others, it is not surprising that he is so popular, particularly as a lecturer. The "driest" subjects, in his hands, are made interesting: we might anticipate, therefore, that so importsnt a subject as the Steam Engine, would lose none of its attractions. The book before us fully realizes the anticipation. It is replete with interesting facts, which are made still more so by the manner in which they are introduced. Although the work is intended for the general reader, it contains much practical information, which the author has been able to obtain in consequence of his well-known celebrity as a scientific man. He gives a clear succinct history of the Steam Engine; an account of the various improvements that have been made in it; its various applications on land and water; and the whole is made interesting by a variety of pleasing illustrations. The present edition contains many improvements on the last. From it we extract the following account of the manner in which Watt obtained a remuneration for his labour, in improving the Steam Engine:—

WATT'S REVENUE FROM HIS PATENT —"The manner in which Watt chose to receive remuneration from those who used his engines was as remarkable for its ingenuity, as for its fairness and liberality. He required that one-third of the saving of coals effected by his engines hitherto used, should be paid to

Digitized by Google

him, leaving the benefit of the other two-thirds to the public. Accurate experiments were made to ascertain the saving of coals: and as the amount of this saving in each engine depended on the length of time it was worked, or rather on the number of descents of the piston, Watt invented a very ingenious method of determining this. The vibrations of the great working beam were made to communicate with a train of wheelwork in the same way as those of a pendulum communicate with the work of a clock. Each vibration of the beam moved one tooth of a small wheel, and the motion was communicated to a hand or index, which moved on a kind of graduated plate like the dial plate of a clock. The position of this hand marked the number of vibrations of the beam. This apparatus which was called the *counter*, was locked up and secured by two different keys, one of which was kept by the proprietor, and the other by Bolton and Watt, whose agents went round periodically to examine the engines, when the counters were opened by both parties, and examined, and the number of vibrations of the beam determined, and the value of the patent third found.

The extent of the saving in fuel may be judged from this: that for three engines erected at Chacewater mine in Cornwall, it was agreed by the proprietors, that they would compound for the patent third, at £2400 per annum; so that the whole saving must have exceeded £7200 per annum."

Watt, like nearly every other inventor, had to contend against strong prejudices, before he could get his engines into general use. Dr. Lardner makes the following excellent remarks on this subject:—

THE EFFECTS OF PREJUDICE.—Notwithstanding the manifest superiority of these engines over the old atmospheric engines, yet such were the influence of prejudice and the dislike of what is new, that Watt found great difficulties in getting them into general use. The comparative first cost also probably operated against them, for it was necessary that all the parts should be executed with great accuracy, which entailed proportionally increased expense. In many instances they felt themselves obliged to induce the proprietors of the old atmospheric engines to replace them by the new ones, by allowing them in exchange an exhorbitant price for old engines, and in some cases they were induced to erect engines at their own expense, upon an agreement that they should only be paid if the engines were found to fulfil the expectations, and brought the advantages which they promised. It appeared since, that Bolton and Watt had actually expended a sum of nearly £50,000 on these engines before they began to receive any return. When we contemplate the immense advantages which the commercial interests of the country have gained by the improvements in the steam engine, we cannot but look back with disgust at the influence of that fatal prejudice which opposed the progress of improvement under the pretence of resisting innovation. It would be a problem of curious calculation to determine what would have been lost to the resources of this country, if chance had not united the genius of such a man as Watt with the spirit, enterpr ie, and capital, of such a man as Bolton! The result would reflect little credit on those who think novelty alone a sufficient reason for opposition.

## COALS.

NAPTHA is an article which is found in great abundance in Persia, and is as fluid and transparent as water; but when exposed to the air it becomes yellow, and then brown; its consistence is increased, and it passes into *petroleum*. Petroleum is found native in many countries, and by an exposure to the air becomes *mineral tar*. Mineral tar is found native, which by exposure to the air passes into *mineral pitch and maltha*. By further induration this passes into asphaltum, which substance is likewise found native in many parts of the world. Common coal is a composition of some of these bitumens and charcoal. The French jet and the English cannal coal are both so hard that they are susceptible of polish, and are frequently wrought into trinkets.

*Effect of Chemical Action.*—Make a little charcoal perfectly dry, pulverize it very fine, and put it into a warm teacup. If some strong nitrous acid be now poured upon it, combustion and inflammation will immediately ensue.

Digitized by Google

### A PAGE FOR CHRISTMAS TIME.

As this is the season of the year when, more than at any other, the ingenuity of young people is exercised for the purpose of amusing their friends and themselves, by performing various simple experiments, and exhibiting some of the "wonders of science," we are sure we shall be excused, even by those who take no part in such "Christmas gambols," for devoting a page to the use of our young friends, to assist them in their exertions. The experiments described are pleasing and unattended by danger.

*For "Snap Dragon."*—A little spirits of wine will be found far superior and much cheaper than gin or brandy. The flavour of the latter is of little importance; it is only the spirit they contain that is useful, and they are generally very much adulterated.

*An amusing experiment,* showing the effect of homogeneous light, may be performed as follows:—Place a piece of tow in a vessel containing spirits of wine, and set fire to it, then throw a little salt upon the flame: the light produced will make everything in the room to appear of a different colour to what it really is; in particular, the faces of every individual present will seem to be ghastly white, the red colour of the cheeks being entirely changed. When the light is extinguished everything of course resumes its natural appearance.

*Optical experiments.*—If you fix three different coloured wafers against the wall of a room at equal distances, at the height of your eye, placing yourself directly before them, at a few yards distance, and close your right eye, and look at them with your left, you will see only two of them, suppose the first and second; alter the position of your eye, and you will see the first and third; alter your position a second time, you will see the second and third, but never the whole three together; by which it appears, that a person who has only one eye can never see three objects placed in this position, nor all the parts of one object of the same extent, without altering the situation of his eye. This effect is in consequence of the image of one of the wafers falling on point of the retina of the eye where the optic nerve enters. At this point the nerve is insensible to the impression of objects.

*Two cold Liquids on being mixed together produce a boiling hot Liquid*—Take a small phial, about half full of cold water, grasp it gently in the left hand, and from another phial pour sulphuric acid very gradually into the water: the mixture will immediately become so hot that the phial cannot be held. This is in consequence of the particles of water and sulphuric acid coming into such close connexion, that part of their *latent heat* is given out.

*Experiments in Galvanism.*—Place a piece of metal zinc under the tongue, and a piece of copper (a penny piece) upon the tongue, and bring the extremities of the metals into contact—the result will be the immediate perception of a curious *taste* something resembling the taste of copperas. The metals have not this taste when not in contact; and therefore this experiment clearly shows the influence of excited galvanic electricity upon the organ of taste.

Moisten the under lip; lay upon it a shilling, with the edge of it *beneath* the tongue; lay *upon* the tongue a piece of zinc, and bring the edges of the pieces of metal into contact—instantly the shilling will feel so intolerably hot, that you will be obliged to let it fall from your mouth.

Place a piece of zinc under the tongue, and put the small end of a silver teaspoon in the mouth, between the teeth and under the lip, passing it up as high as possible, and pressing the extremity of it against the gums; then let the lower part of the spoon touch the edge of the piece of zinc—at the moment of contact, a flash like lightning appears to the eye, which is renewed as often as you let the two metals touch each other. If you shut your eyes when you perform this experiment, you still see the light; and if you look sternly at a candle, or other light, still you see it.

*To melt Iron in a moment.*—Bring a piece of iron wire to a white heat, and then apply to it a roll of sulphur; the iron will immediately melt, and run into drops. This experiment should be performed over a basin of water, in which the drops that fall down will be quenched. These drops will be found reduced into a sort of cast iron.

Digitized by Google

*Number of species of Insects.*—Dr. Imhoft, in a work presented to the Society of Natural History, at Basle, has estimated the number of insects now known, at 560,000 species, Germany alone containing 14,000.—*Athenæum.*

*Scales of Fishes.*—A. M. Dumeshil, of Wunstrof, states that, according to his observations, the metallic lustre of the scales of fishes is due to the presence of the purest silver; and that the 12,000th part of a grain of silver is contained in the scale of a carp.

## INSTITUTIONS.

*Meteorological Society.*—Dr. Birkbeck, President, in the chair.—A meeting of the members of this Society took place in the committee room of the Mechanics' Institution, Southampton-buildings, Holborn, on Tuesday last. After the minutes of the preceding meeting had been read, and several new members entered on the list, the secretary read extracts from letters recived from the counties of Dorset, Monmouth, Middlesex, Berkshire, Bedford, Warwick, and also from Belfast and Dublin, each giving an account of the hurricane which passed over England on the 29th ult. From the various statements received, it appears that the hurricane was terrific in Dorsetshire, scarcely felt in Warwickshire, and not the least felt at Edinburgh. It appeared also from the accounts received, and from what was stated by several gentlemen present, who were witnesses of its progress, that the hurricane was a species of whirlwind passing over a certain extent of country in the form of an elliptic or parabolic curve, carrying its devastating force in the various foci of the curve. W. R. Birt, Esq., author of the "Tabula Anemelogicæ." explained by some beautiful charts the periodical curves described by the wind. Patrick Murphy, Esq., a celebrated meteorologist, and author of several meteorological works, presented the Society with his last publication and a paper entitled "Anticipated state of the weather during the approaching month of January 1837." We understand Mr. Murphy purposes at the next meetiug of this Society to be held on the 10th of January, to explain to the Society the principles upon which his predictions are founded. Mr. Birt also intends to give a continuation of his papers on the "curves described by the wind," in which he will prove that the curve is completed in about three years. Persons connected with scientific societies, and those who are interested in meteorological science, as well as the members of the Society are cordially invited to attend the next meeting.

Mr. Robert Messiah.—It was with extreme regret that we heard of the decease of this gentleman, so well known to the members of the London Mechanics' Institution as an active friend to it, and a young man of great promise A correspondent. (Mr Engall) has written us, suggesting that "as the London Mechanics' Institution may be considered his intellectual parent, those members who entertain a respect for his memory should testify it by subscribing to erect a tablet, to be placed in the hall of the Institution, or in some other convenient situation."

*Query.*—"J. F. P." wishes to know the best *Practical* way of finding the length of focus of convex and concave glasses.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Tuesday evening, Dec. 27, at seven o'clock. Dr. Birkbeck on Insects.—Thursday afternoon, Dec. 29, at one, Mr. Sheridan Knowles on the Drama.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Dec. 28, at half-past eight, Lecture on Juries and Witnesses.—Friday, Mr. Haydon on the Fine Arts.

*Aldersgate Street Institution.*—Wednesday, Dec. 28, at half-past eight, Robert Adams, Esq., on Optics.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday Dec. 21, at half-past eight, Mr. Francs, on Botany.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge-road.—Tuesday evening, Dec. 27 at half-past eight o'clock, T. Griffith, Esq., on Alchymy.

*Islington Literary and Scientific Society.*—Thursday, Dec. 29, at eight o'clock, Mr. Severn, on Music, with illustrations.

*Eastern Literary and Scientific Institution*, 88, Hackney-road.—Tuesday, Dec. 27. G. S. Sacket, Esq., on Astronomy.

*Mutual Instruction Society*, Great Tower-street,—Monday, Dec 26, at eight o'clock, Quarterly Meeting.

### TO CORRESPONDENTS.

We shall have much pleasure in inserting communications from Mechanics and others, whatever may be their style of composition, if their information is likely to prove generally interesting.

Accepted, with thanks, "John Gregory," "A Reader," Chromatikos," and "J. King."

"S. W, S.'s" article would not be sufficiently interesting unless it formed part of a series.

Enquiries from "R. W," and respecting "Oil Gas," next week.

We shall be happy to receive the account of an improved Fire Escape from "Mr. Wivell."

All Letters must be addressed "To the Editor,' post paid.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC.

## A MAGAZINE OF ARTS AND SCIENCES.

No. IX.] SATURDAY, DEC. 31, 1836. [Vol. I.

### STEAM BOILERS.

FIG. I.

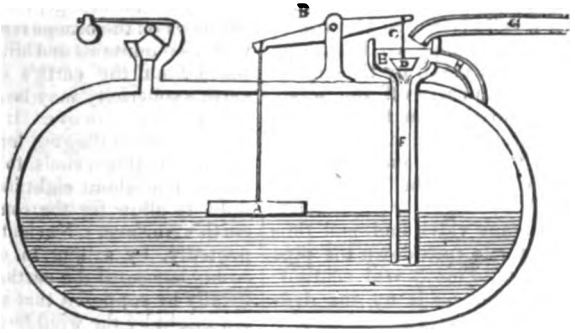
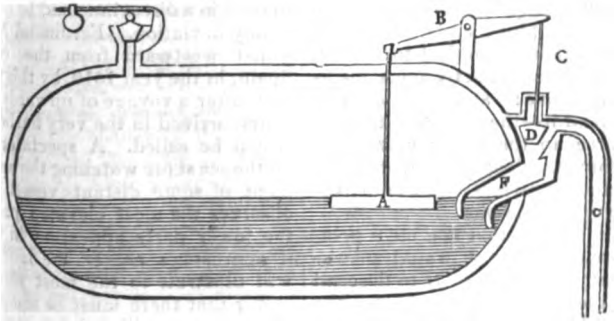



FIG. II.






Holloway Press: D. A. Doudney

Digitized by Google

## STEAM BOILERS.

*To the Editor of the Penny Mechanic.*

SIR,—Having seen in No. VII., the ingenious invention of Mr. Douglas. which tends greatly to add to the safety of steam boilers, I think the mode of supplying the boiler with water is not the best that can be adopted, it having one great fault, namely, the pump might either force too much or not enough, which would cause great danger; I beg therefore to suggest a simple remedy.

[*See Engraving—Fig.* 1.]

A is a float, which the rising or falling of the water in the boiler will naturally affect; B is a small steelyard, which is attached; C, the rod which acts on the valve D, which is immersed in the water, E; this water is contained in a small cistern on the top of the pipe F, that is supplied by a pipe G, from a pump worked by the engine. The pipe H is to carry off the waste water, not required for the boiler. Now when the water is low in the boiler, the float will descend, and of course cause the float end of the steelyard to descend with it; the other end ascending, will open the valve end, and thus allow the water to rush down the pipe into the boiler. This it will continue to do until it has made up the deficiency caused by the conversion of a portion of the water into steam; and as long as the water generates steam, so long will the water valve repay the boiler.

My motive for having a pipe to descend below the surface of the water in the boiler, is because the pressure of the steam will only be according to the diameter of the pipe; and if there were no pipe, it would be subject to the full pressure of steam, exactly the same as the safety valve: and another evil would attend it—the pressure of steam would force up the water valve, and thereby force the float under water, and render it totally useless. It would likewise be very dangerous.

I am of opinion that one on a principle shown in Fig. 2, would answer for a boat, for the pipe G to descend through the bottom of the boat; the water would naturally ascend to find its level, and, if the water valve were open, as represented at D, fig. 2, the water would rush down; and, if shut, it would form a sort of reservoir, so as to be in readiness as fast as the water generates steam.

Your Subscriber and Well-wisher,

T. KING.

*No. 8, Lucretia-street, Lambeth Marsh.*

## GLOBULAR SHAPE OF THE EARTH.

IN remote antiquity, the notions laid down with respect to the shape of the earth, were both various and absurd; one of the most general was, that the earth was a flat, circular body, floating on the water; but as mankind grew more enlightened, these ideas were seen to be quite preposterous.

The earth in shape may be compared to that of an orange, the small protuberances on the orange representing the various mountains and hills interspersed throughout the earth's surface. The earth's sphericity may be accounted for in a variety of ways. It is necessary for men when digging for the purpose of constructing canals, to make an allowance of about eight inches to every mile, to allow for the convexity of the earth's surface. Navigators have repeatedly, by sailing in one direction, *circumnavigated* the earth. It may naturally be supposed that a ship at open sea might by the wind be driven round, and consequently change the direction of its course, so that the vessel would be directed homewards, though the earth's surface were that of an extended plane; but the fallacy of this idea is very evident, for by the invention of the mariner's compass, we are enabled to steer in a direct line, and be conscious of any deviation. Ferdinand Magellin sailed westward from the coast of Spain, in the year 1519, by this method, and, after a voyage of upwards of three years, arrived in the very harbour from which he sailed. A spectator situate on the sea shore watching the approachment of some distant vessel, always observes the most elevated parts first, the lower parts appearing in view as it approaches nearer the land, which will illustrate to the most simple observer that there must be some protuberance, or swelling, between the spectator and the ship; for the hull of the vessel being so much larger than any

Digitized by Google

other part of it, would, supposing the surface of the sea to be a flat plane, appear in sight when the other parts were scarcely perceptible.

If the earth were not a spherical body, why could the horizon be more extended every way the higher the position we choose? and why present a circular shadow on the moon during an eclipse? The cause of the globular form of the earth is very clear, if it be considered at first as having been a liquid mass capable of assuming any form, for then the particles of matter contained in it would, by the attraction of gravitation, tend towards the common centre, and a spherical form would therefore be produced. But it has been ascertained that the earth is not perfectly round, it being flattened a little at the poles, or at the extremities of the axis round which it turns. This may be accounted for by the centrifugal force of the earth, by which it has a tendency to recede from its centre, caused by its revolution round its axis, and the extension one way producing a contraction the other; but this difference may be considered as nothing, when compared with the size of the earth. The axis of the earth is a supposed line passed through its centre, terminating both ways at the poles, round which axis the earth revolves in 24 hours, the revolutions producing the alternate succession of day and night. There are other proofs of the earth's globular form, but, thinking the above quite sufficient to convince the most ordinary mind of its sphericity, it would be useless to dwell further upon it.

A READER.

## THE STEAM ENGINE.

NO. IV.

Our last paper on this subject, in No. V., brought the history of the steam-engine down to the time of Papin. We mentioned him before Captain Savery and Newcomen, whose inventions will be described hereafter, because he engaged in various experiments on the subject as early as 1688, although he did not publish his work on "a new method of raising water by fire," until eight or nine years after Savery obtained his patent. Papin having been a Frenchman, the French attach far more importance to his discoveries than they deserve. There can be no doubt, however, that his experiments were of much service to those individuals we are about to mention, who greatly perfected the steam-engine both in its principle and machinery.

In the year 1698, a person of the name of Savery, a captain of a merchant's vessel, constructed an engine which, for ingenuity and usefulness, far surpassed every attempt that had been previously made to render the power of steam subservient to man. The invention of this engine strikingly exemplifies how "great events from trifling causes spring," and adds another instance to the many already existing, of discoveries of the greatest importance to man, which have been made by accident. Captain Savery relates, that after drinking some wine at a tavern, he flung the flask in which it had been imported on the fire, and called for a basin of water to wash his hands before leaving the house. It appears that the flask contained a small quantity of wine, which soon began to boil and form steam. Savery perceiving this, thought he would see what would be the effect of his inverting the neck of the bottle in the water. He did so, and immediately the water rushed up the neck of the flask and filled it. Savery states that it was this simple circumstance which suggested to him the idea of the engine he afterwards constructed.

Any person who will take the trouble may perform the experiment mentioned, and it is worth trying. A Florence flask may be obtained at every oil shop, and if a little water, or, what is better, a little alcohol, be made to boil in it, and the neck of it be then inserted in some water, the flask will be immediately filled. The cause will be at once understood by those who are acquainted with the properties of the atmosphere; to those who are not we offer the following explanation:—

If we insert a beer tumbler in a basin of water, we shall find that the water does not rise so as completely to fill the tumbler, however low we may push it into the water. This is because the tumbler contains a certain quantity

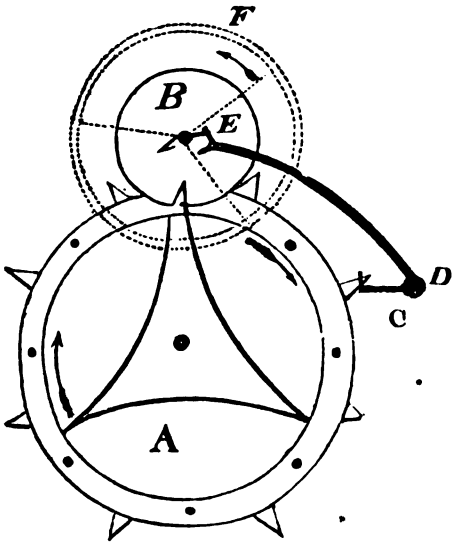
Digitized by Google

of air, which resists the ascent of the water. It is on this principle that diving bells are constructed. A man may go down in one without getting the least wet, if the inside of the bell is well supplied with fresh air. Now, the atmosphere presses with a weight of about 15 lbs. on every square inch of surface of all bodies on the earth, and it must therefore be evident, that if we could by any means abstract the air from within the tumbler, the water would be forced up into it, by the pressure of the atmosphere on the surface of the water without. Under the circumstances we have mentioned, this event invariably takes place. The air may be abstracted, or, in other words, a vacuum may be formed by various means: for instance, we can produce it by an air pump, or we can produce it by filling a vessel with steam, and then condensing it into water, by the abstraction of the heat necessary for its existence as steam. By either of these means we can obtain a pretty good vacuum. The reader will now, we think, easily understand why the water rose in the flask, when Savery performed his experiment. The bottle was full of steam—this was condensed by the bottle being placed in cold water —a vacuum was formed within it, and the water being pressed by the atmosphere, was forced up the neck of the flask to fill this vacuum. Although every schoolboy can perform this experiment now, yet it is deserving of remembrance, both as exhibiting the great ignorance that formerly prevailed on scientific subjects amongst persons generally, and the unworthy feelings that sometimes actuate men, and induce them to depreciate the meritorious exertions of others, that Dr. Desaguliers denied the truth of Savery's statement; affirmed that he could never have performed the experiment he describes; and endeavoured to deprive him of the honour of the invention, and give it to the Marquis of Worcester! The Doctor says, "I made the experiment purposely with about half a glass of wine left in a flask, which I laid upon the fire till it boiled into steam; then pulling out a thick glove to prevent the neck of the flask from burning me, I plunged the mouth of the flask under the water that filled the basin: but the pressure of the atmosphere was so strong, that it beat the flask out of my hand with violence, and threw it up to the ceiling. All this must have happened to Capt. Savery: if he had ever made the experiment, he would not have failed to have told such a remarkable incident, which would have embellished his story"! Desaguliers was a man of much scientific knowledge, and his opinions are therefore entitled to some degree of respect; but, on an examination of Savery's engine, it will be seen that it is constructed entirely in accordance with the principle illustrated by the experiment of the Florence flask.

Savery soon perceived that if he could produce a vacuum, by means of steam, in a vessel at a certain height above water, and allowed a pipe to pass from the vessel to the water, the latter could easily be raised to the height that the pressure of the air will support a column of water. It is found that a column of water, one inch square at the base, and 34 feet high, weighs about 15 lbs., and is therefore exactly counterbalanced by the pressure of the atmosphere, which will accordingly force water up this height, if a vacuum be formed; Savery therefore perceived that he had only to form a vacuum by means of condensing steam, and he could then raise water 34 feet. It also occurred to him that he might employ the expansive power of steam as used in De Caus's engine, and thus force the water still higher. All this Savery effected, and, by doing so, led the way for the brilliant inventions that were afterwards made in the construction of the steam-engine. The principal use which Savery proposed applying his engine was to raise water from mines —indeed, this was the great object of all the speculators and inventors of the period, for, in consequence of no efficient means of draining, the valuable mines of England appeared likely soon to become quite unproductive. Savery dispelled these fears, and we may justly claim for him the honour of being the first person who applied the steam-engine to a really useful object. His engine shall be described in our next paper on this subject.

Digitized by Google

## GREGORY'S DETACHED ESCAPEMENT FOR WATCHES.




EXPLANATION OF ENGRAVING. — A is the scape-wheel, containing 15 teeth, with upright teeth in the rim, half-way between the horizontal ones, similar to a duplex-wheel. B is the roller, as in a chronometer; with its harbour, to which the balance F is attached; also, the pin acting in the fork E. C is the locking dittent attached to the harbour D, also the fork E. The dotted circle represents the balance, which is too small as represented; it must be rather larger than the scape-wheel. A lever train is adapted for the above escapement.

The action is as follows:—The upright teeth in the scape-wheel acting in the roller, as represented, occasions it to revolve in a contrary direction to the wheel; and the ruby pin in the harbour acting in the fork, unlocks the wheel, and a whole tooth drop is obtained. The upright teeth in the scape-wheel are set the same depth in the roller as the pin in the fork, and the locking dittent in the horizontal teeth of the scape-wheel; they are therefore all relieved at the same instant, thus doing away with a great deal of friction which exists in the lever. The scape-wheel revolves in the direction represented by the darts.

J. G.

## SIR ISAAC NEWTON.

ACCORDING to information which Sir Isaac himself gave to Mr. Conduit, he seems to have been very inattentive to his studies, and very low in the school. The boy, however, who was above him, having one day given him a severe kick upon his stomach, from which he suffered great pain, Isaac laboured incessantly till he got above him in the school, and from that time he continued to rise till he was the head boy. From the habits of application which this incident had led him to form, the peculiar character of his mind was speedily displayed. During the hours of play, when the other boys were engaged with their amusements, his mind was occupied with mechanical contrivances, either in imitation of something which he had seen, or in execution of some original conception of his own. For this purpose he provided himself with little saws, hatchets, ham-

Digitized by Google

mers, and all sorts of tools, which he acquired the art of using with singular dexterity. The principal pieces of mechanism which he thus constructed were a windmill, a water-clock, and a carriage put in motion by the person who sat in it. When a windmill was erecting near Grantham, on the road to Gunnerby, Isaac frequently attended the operations of the workmen, and acquired such a thorough knowledge of the machinery, that he completed a working model of it, which excited universal admiration. This model was frequently placed on the top of the house in which he lodged at Grantham, and was put in motion by the action of the wind upon its sails. Not content with this exact imitation of the original machine, he conceived the idea of driving it by mechanical power, and for this purpose he inclosed in it a mouse, which he called the miller, and which, by acting upon a sort of tread-wheel, gave motion to the machine. According to some accounts, the mouse was made to advance by pulling a string attached to its tail, while others allege that the power of the little agent was called forth by its unavailing attempts to reach a portion of corn placed above the wheel.

---

THE BRAIN.—(From a very good and very cheap edition of Brigham on Mental Cultivation, edited by Mr. Macnish. Whittaker.)—The brain of a new-born infant weighs about ten ounces; that of an adult, generally, three pounds and a half, apothecaries' weight, frequently a little less.—But if the mind of an adult has been long devoted to thought, if he has been engaged in constant study, his brain is usually increased beyond this weight. The brain of Byron, for instance, is said to have weighed four pounds and a half, and that of the illustrious Cuvier four pounds, thirteen ounces, and a half. The size of this organ increases from the time of birth till manhood, remains stationary from this period until old age, and then diminishes in bulk and weight. The relative size of its different portions constantly varies during the first part of life, and it is not until about the seventh year that all its parts are formed. During childhood it is "very soft, and even almost liquid under the finger, and its different parts cannot be clearly distinguished." Still at this time it is supplied with more blood, in proportion to its size, than at any subsequent period. It then grows most rapidly, and more rapidly than any other organ; its weight is nearly double at the end of the first six months; and hence the nervous system, being connected with the brain, is early developed, and becomes the predominating system in youth. At this period of life, however, which is devoted to the increase of the body, it is necessary that the nervous system should predominate; for this system is the source of all vital movement, and presides over, and gives energy to those actions which tend to the growth of the organization.—Besides, "Infancy," says Bichat, "is the age of sensation. As every thing is new to the infant every thing attracts its eyes, ears, nostrils, &c. That which to us is an object of indifference, is to it a source of pleasure. It was then necessary that the nervous cerebral system should be adapted by its early development to the degree of action which it is then to have."

It is, then, deeply important, that the natural action of the nervous system, should not be much increased, either by too much exercise of the mind, or by too strong excitement of the feeling, lest, at the same time, the liability of children to nervous diseases be increased, and such a predominance given to this system as to make it easily excited, and disposed to sympathize with disorder in any part of the body; thus generating a predisposition to the hypochondriasis and numerous afflicting nervous affections.

Mental excitement, as has been shown, increases the flowing of blood to the head, and augments the size and power of the brain, just as exercise of the limbs enlarges and strengthens the muscles of the limbs exercised. The wonderful powers of mind which an infant or child sometimes manifests, and by which he surpasses ordinary children, do not arise from better capacity in the mind itself of the child, but, in fact, from a greater enlargement than usual of some portion or the whole of the brain, by which the mind is sooner enabled to manifest its powers. This enlargement takes place whether the mental precocity arises from too early and frequent exercise of the mind, or from disease, and it must arise in one of these two ways. But in my opinion,

Digitized by Google

mental precocity is generally a symptom of disease; and hence those who exhibit it very frequently die young.

### SUDDEN BREAKING OF LAMP GLASSES.

MANY of our readers have doubtless, at one time or another, been surprised at the occasional extraordinary brittleness of the glasses used for gas lights, &c. Very often, after being in use for a length of time, they suddenly break, without any assignable cause. The reason they do so, if explained, may be the means of saving some of our readers occasionally a shilling or two; the following explanation may therefore be serviceable:—

Glass is a very bad conductor of heat; in consequence of which, one part of its surface is often made to expand before the heat can pass through it to the rest, and as the glass is not elastic, a crack must follow. But, besides this, there is a curious character possessed by glass, and a few other vitreous bodies, of having the state of tension of their particles, if not their polarity, altered by sudden changes of temperature, which causes them to fall to pieces when acted upon by the slightest vibration or changed in the degree of heat. The ingenuity of the manufacturer has enabled him to remove this property of glass, by means of a process called annealing. This is effected by cooling the glass slowly from the high temperature at which it is formed. By annealing, the glass acquires a toughness, which enables us to use it for philosophic and domestic purposes, within a moderate range of temperature; but, when exposed to high temperatures, the glass so far returns to the un-annealed state, and resumes its tendency to fall to pieces from the slight vibration or change of temperature to which it may be exposed.

The high temperature to which the heat of the gas raises the glass chimneys, partially removes the annealing, and rapid cooling leaves them very brittle. The remedy, however, is as obvious as the cause; all we have to do is to put the flame gradually out, and thus we allow the glass to cool slowly, and, in fact, repeat the process of annealing.

It is remarkable how slight a vibration is sometimes sufficient to break an un-annealed crystal vessel, especially when it is thick; if a glass chimney be placed upon the floor, at one end of a room, the vibration communicated to it by a person walking across the same piece of wood, at the other end of the room, is often sufficient to cause it to fall to pieces; or, if the glass chimney be put near an open door, the current of air entering sometimes produces the same result.

### SOCIETY OF ARTS' PRIZES.

THIS Society offers premiums for inventions or improvements on the following subjects, amongst others. Claims for premiums, with full descriptions, certificates, and samples where necessary, are to be sent in on or before the first Tuesday in February.

*Agricultural Machines.*

For inventing or improving machines for performing, in a superior manner, or at a cheaper rate, any agricultural operations.

*Generation of Steam.*

For the best method of generating steam, in such a manner that its quantity or force shall be materially increased, without increase of danger or expense;—*the Gold Medal.*

*Prevention of Smoke.*

For a method superior to any in use, and verified by practice, of preventing the emission of dense smoke from the chimneys of furnaces and fireplaces;—*the Gold Medal.*

*Preventing Noxious Vapours in Manufactories.*

For a method, superior to any in use, and verified by actual trial, of preventing the ill effects arising from noxious fumes disengaged in smelting ores or in other chemical or manufacturing processes;—*the Gold Isis Medal.*

*Bar Iron.*

For any material improvement in the manufacture of bar iron;—*the Gold Medal.*

*Copper, Zinc, and Brass.*

For any improvement in the manufacture of either copper, zinc, or brass,

Digitized by Google

so as to render them equal in quality to the same imported from abroad;—*the Gold Medal.*

*Glass.*

For any material improvement in the manufacture of flint or of crown glass;—*the Gold Medal.*

*Copper-plate Printers' Ink.*

For the best composition for printers' ink, superior to any hitherto known, and fit for the finest kind of copper-plate printing;—*the Gold Isis Medal.*

*Dry Rot and Mildew.*

For a method or methods of preventing dry rot or mildew in timber, canvass, or other vegetable substances, superior to those already in practice;—*the Gold Medal.*

*Preventing the destructive effects from Moths.*

For a method of preventing the destructive effects occasioned by moths and other insects, in furs, woollens, specimens of natural history, books, and other articles, superior to any hitherto known or practised;—*the Gold Medal.*

*Lithographic Stone.*

For the discovery in the United Kingdom, or in any British colony, of a bed of stone equal to the best German stone, for the purposes of lithography;—*the Gold Isis Medal.*

For useful communications on any of the applications of Chemistry to the Arts and Manufactures, especially in dying and calico-printing, and in the preparation of acids, alkalis, and compound salts, the Society will give gold or Silver Medals, or Pecuniary Rewards, according to circumstances.

*The Moon.*—M. Gruithuisen, the indefatigable professor of Munich, now publicly declares, that the moon has an atmosphere, and, consequently, clouds. He says that he has seen annular mountains, which are named Eudoxia and Aristotle in his map, covered with a number of points, which in anterior observations had occupied a different position. These moveable points the Professor thinks can be nothing else than the clouds in the moon's atmosphere.

*Radish.*—The boiled roots of this vegetable form an excellent dish when served up as asparagus.

*Useful Cement for Turners and Artizans in general.*—Sixteen parts of whiteing are to be finely powdered and heated to redness, to drive off all the water; when cold, it is to be mixed with an equal quantity of rosin, and one part of bees-wax; the latter having been previously melted together, and the whole stirred till of an uniform consistence.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Tuesday evening, Jan. 3, at seven o'clock, Dr. Birkbeck, on Insects.—Thursday afternoon, Jan. 5, at one, Mr. Sheridan Knowles, on the Drama.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Jan. 4, at half past eight, E. Cowper, Esq., on the Printing Machine.—Friday, Mr. Haydon, on the Fine Arts.—On Saturday, Jan. 7, Mr. Hickson will deliver a Lecture (to which the public will be admitted *gratuitously*) on the Introduction of Vocal Music as a branch of National Education.

*Aldersgate Street Institution.*—Wednesday, Jan. 4, at half past eight, Robert Adams, Esq., on Optics.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Jan. 5, at half-past eight, Mr. Francis, on Botany.

*Islington Literary and Scientific Society.*—Thursday, Jan. 5, at eight o'clock, Mr. Severn, on Music, with illustrations.—Friday, 6th, a Literary Meeting, Essay and Discussion.

*Mutual Instruction Society*, Southampton Coffee-House, Chancery-lane.—Essay on the Question, "Should early Marriages be encouraged?"

## QUERIES.

Can any of your readers inform me the cause of the falling of meteoric stones, or whence do they come? Also, what is the reason of falling stars?
*Strand, 26th Dec.*, 1836. J. C.

Logarithms.—I should be glad to hear, through your useful periodical, of some of the latest works upon Logarithms. R. W.

## TO CORRESPONDENTS.

We did not receive "Mr. Simpson's" communication until after a Report had appeared in another Magazine, or the article should have been inserted.

We are sorry we could not answer "Mr. Wayman" last week: he will find the address on the cover of the periodical he mentions.

Railways next week.

Received "Mechanicus;" "W. R.;" "S. Johnson;" "A Reader;" and "M. A. N."

"Mr. John Gregory's" paper on an improvement in Balloons, if possible, in our next.

All Letters and Books for Review should be addressed "To the Editor," at the Publisher's, post paid.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

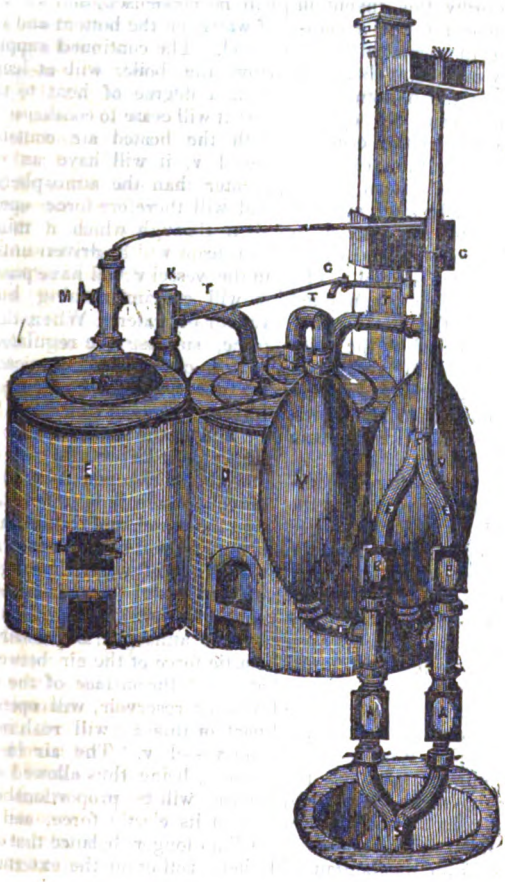
Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. X.] SATURDAY, JAN. 6, 1837. Vol. I.

## SAVERY'S STEAM ENGINE.




## THE STEAM ENGINE.

NO. V.

The Engraving on our front page is a representation of Savery's steam engine. The circumstances that led to its construction we detailed in our last number, and we need therefore at present only describe the mechanism and action of the engine. D and F are two boilers, of which D is the larger. From these the pipes T T arise; and through them the steam is sent to the other part



Holloway Press: D. A. Doudney.

Digitized by Google

FIG. I.

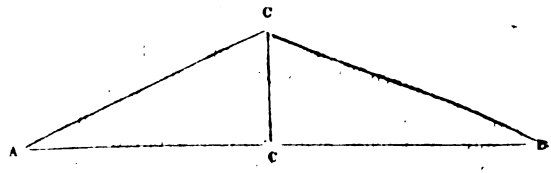
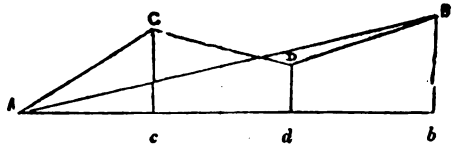



FIG. II.




Thus in fig 1, let A and B be two places, between which it is desirable to form a Railway; but that it is necessary to rise to the elevation of C, and then to descend on the opposite side: let A C, and C B, be each equal to one mile: and the rise, C *c*, equal to 9.5ft.: then the power necessary to carry 1 ton from A to B will be as follows:—from A to C, 1 mile = 8lbs. friction, + 4lbs effect of gravity = 12lbs.; from C to B 1 mile, 8lbs friction, —4lbs effects of gravity + 4lbs., making + 12lbs. = 16, which is the same as though the road between A and B were level, at the rate of 8lbs. per ton per mile; because the additional resistance, occasioned by the effect of gravity, in ascending from A to C (4 lbs.) would act as a propelling power when the goods descended from C to B, and therefore must be deducted, which would cause the whole power to be 16lbs. for the two miles, or 8lbs. per mile, as on a level.

Again in fig. 2, let A and B be the two places; then let A C, C D, D B, each equal one mile; C *c* = 9.5ft., D *d* — 4. 75 ft., and B *b* = 14.25 ft then the power necessary to convey one ton of goods from A to B will be as follows:—From A to C. 1 mile, = 8lbs., friction + 4lbs. effect of gravity = 12lbs.; from C to D 1 mile = 8lbs. friction — 2 lbs. effect of gravity = 6 lbs.; D to B 8lbs. friction + 4 lbs. effect of gravity = 12 lbs., making 12 + 6 + 12 = 30 lbs. at the rate of 10 lbs. per mile, the same as rising from A to B in one plane, A to B being 3 miles, and to *b* 14.55 ft., which would be 24 lbs. friction, at the rate of 8lbs. per mile; and 6lbs. effect of gravity, at the rate of 2lbs. per mile, making 10lbs. per mile, the same as before; the effect of gravity in ascending one plane being counteracted by descending another; but this is not the case when the inclination of the plane exceeds 19ft per mile, the inclination at which a body will descend the plane by its own gravity; because, suppose the planes A C and C B, fig. 1, to be each one mile, and the elevation C *c*, to be 21 ft. then the power necessary to carry one ton of goods from A to B will be as follows:—A to C=8lbs. friction, gravity = 16 lbs. = 24lbs. but the resistance from A to C being only 8lbs. friction, we can only make use of 8 lbs. of the 16 lbs. from the effect of gravity, 8 lbs. of which is consequently lost; so that we see that the compensation for the effect of gravity is lost if the inclination of a plane exceeds 19 feet per mile, when the effect of gravity equals the friction.

On a Railway constructed with variable gradients, the resistance of the load varies according to the angle of

Digitized by Google

the plane on which it happens to be travelling; and as it follows that the engine must have sufficient power to overcome the greatest resistance, it will become necessary to employ an engine of greater power and weight than on a level road, where assistance is made use of to ascend the planes: it also follows, that the rate of travelling will vary also, because, when an engine of sufficient power to overcome the resistance of the steepest inclined plane, at the rate of 10 miles per hour, is used, it would travel at a very much greater rate than when on a plane of less inclination, say 30 miles per hour, which would be the most rapid rate of travelling; the engines are therefore exposed to considerably more wear and tear than if they were kept going at a regular speed. In addition to which, a locomotive engine is not so well adapted to raise a weight as it is to overcome the friction; because when an engine ascends an inclined plane the pressure on the plane is diminished, and consequently the adhesive power between the rails and the wheels of the carriage; and if the resistance should surpass the power of adhesion, all locomotion would cease.

Now a Railway constructed upon the principle of a series of level planes, connected by steep inclined planes, has considerable advantages over one of variable gradients. In the first place, the engines act upon much more advantageous principles upon a level than they do on inclined planes, as I have before demonstrated; secondly, there is less loss of time in ascending to the necessary elevation at once, and then running a considerable distance upon a level, because the assistant power may be sufficient to maintain the regular speed, and a lighter engine maintain the same speed on a level. Now it will be seen, that in the first plan we can only obtain an average speed, whereas, on the latter, the engines travel at an uniform speed, and therefore admit of being made so that they will be less subject to wear; hence considerable advantages are possessed by the latter over the former plan.

As it is necessary to employ a more powerful engine on a Railway constructed upon the plan of the variable gradients, so also it requires a stronger rail to carry it; while the rails will wear no longer, in point of traffic, than if the engine were lighter and the rails lighter, as the time they will last is according to the time they will carry the engines, which generally form the greatest load, supported upon the same number of wheels in the train; but where powerful locomotive engines are used to assist on inclined planes the rails require to be made stronger than the other part of the road: that strength is only governed by the weight of the assistant engine, and only requires to be laid on that part where the assistant engine travels.

Under these considerations, I should consider the plan of making a Railway on the latter plan, that is to say, a series of level planes connected by inclined planes, preferable to that of the variable gradients. In addition to the arguments already stated, it may be mentioned that the speed and tractive power will be nearly equal in both directions.

The examples I have given in this paper are calculated from the latest and best experiments; namely, that it requires the force of 8 lbs. to draw one ton weight upon a level; and that it requires double that power to draw the same weight upon a plane rising one foot in 280, or 19 feet in the mile, as I mentioned in my last.

---

## NATURAL PHENOMENA.

### ON METEORIC STONES.

We are indebted to a translation of a paper by Proffessor Berzelius, in the last number of the Philosophical Magazine, for the following interesting particulars:—Meteoric stones, as our readers are no doubt aware, are bodies of a peculiar kind, that occasionally fall upon the earth. The largest we are aware of is in the museum of the East India Company. It fell in India.

The author commences, by considering which of the conjectures respecting the formation of meteoric stones is the most probable. That which refers these bodies to eruptions

Digitized by Google

of the volcanos of our earth cannot be supported, on account of the distance of the places where they have fallen from any valcano, and also from the different constitution of volcanic products and meteorities; neither can the opinion of the formation from either the common, or even the accidental constituents of the atmosphere be admitted. Anaxagoras imagined that a stone that fell in his time, in Ægos Potmos, came from another world. This, which is probably a correct opinion, is supported by the researches of our own age. Olbers, in a paper on the fall of a meteorite, which occurred at Sienna, in Italy, on the 16th of July, 1794, suggested, in 1795, the possibility of these bodies being projected from the moon; but it appeared to him much more likely that they came from Vesuvius. Laplace likewise adopted this opinion in 1802. That part of the moon which is turned towards us is covered with elevations, and it is found that there are many mountains which precisely resemble in their external appearance those volcanos of our earth which have craters; these mountains are of such magnitude that the interior of their craters may be seen with good telescopes; and it can be readily perceived that one half of the interior is illuminated by the sun, and the other is in the shade, whilst the circular opening of the crater is extremely distinct. It may then be supposed that these mountains owe their form to the same cause as terrestrial volcanos, viz. to eruptions; but if the force which produces lunar eruptions is as considerable as the projectile force of our volcanos, the bodies thrown out ought to be projected much further from the moon than the earth; for, 1st, the mass of the moon is to that of the earth only as 1.45 to 100, and its weight is in the same ratio; 2ndly, the moon has no atmosphere, or, at most, one so highly rarefied, that when the fixed stars are eclipsed by the moon, no refraction of the rays of light can be perceived: consequently the projection occurs in *vacuo*, and without that mechanical resistance to projected bodies which is caused by the atmosphere of the earth, in which they soon become quiescent; 3rdly, if a body is projected towards the earth from the moon the attraction of the earth for it continually increases, whilst that of the moon diminishes more and more; 4thly, the limit of equilibrium between the earth and the moon is much nearer the latter than the former.

Many circumstances connected with the composition of meteoric stones agree with what we know respecting the moon. Some of these bodies contain metallic iron, which, when exposed to air and moisture, is by degrees converted into hydrated peroxide of iron; and this is the case with the minerals of the crust of our globe under such circumstances; therefore, in their primitive situation, they are without atmospheric air, or even possibly without either air or moisture.

Astronomical researches have not as yet discovered in the moon any traces of water large enough to be distinguished by good glasses, and M. Berzelius considers that water has not been met with chemically combined in meteoric stones. The greater number of meteoric stones resemble each other so much in their composition, that they may be considered to come from the same mountain, that is, from the central culminating point of that side of the moon which is always turned towards the earth. A small number only present a different appearance, and it is therefore probable that these proceed from mountains situated on other parts of the moon.

Nevertheless meteoric stones may have their origin in another planet. Olbers considers that the Asteriods between Mars and Jupiter, may be fragments arising from the destruction of a larger planet, an idea which has induced the search for more of these fragments, and the discovery of one of them by Olbers himself. If such a catastrophe has occurred, which seems established by the great angle that the course of Pallas makes with that of the other planets, an immense number of small fragments would be projected in such directions that their course around the sun being diminished, they would then, during their revolution, come within the sphere of attraction of other planets and fall on them.

If we consider meteoric stones as

Digitized by Google

mineralogical specimens, and compare them with those of our earth, we shall find essential differences, even putting out of the question the existence of the native iron. The abundance of magnesia which is in all the chief constituent, the poverty in silica, and the small proportion of the silicates of alumina and of the alkalies, distinguish the meteoric minerals. On this earth it is just the contrary: here silica is the predominant substance, and the silicates of alumina and the alkalies form every where its principal constituents. Magnesia is rare.

The fineness of grain and feeble cohesion of meteoric stones would lead one to snppose that they are projected in a fused state, and consequently resemble the products of terrestrial volcanos, yet this does not appear to be the case. If we carefully examine the texture of a large fragment of a meteoric stone, it will be found to be split, and the fissures filled with another kind of mineral, for the most part of a deeper colour, which indicates a slower and calmer formation. If olivine is found amongst the products of terrestrial volcanos, and rarely in other minerals, it is no proof that it must always be a volcanic product. It is infusible, and is found inclosed in volcanic minerals, because it could not be fused with them. On the contrary, in meteoric stones, it is so uniformly mixed with the other constituents that its presence in these is evidently owing to another cause which does not exist in lava and bassalt.

## THE DAVY LAMP.

The mines of England have undoubtedly been one of the principal causes that have contributed to obtain for her the lofty pre-eminence she enjoys amongst the other nations of the earth. And, by a concurrence of fortunate circumstances, whenever she has appeared in danger of loosing some of the advantages arising from her mines, by natural causes, science has lent its aid to restore what would otherwise have been inevitably lost. For instance, when the miners have carried their operations so deep into the earth, that the difficulty of raising water by pumps was becoming almost insurmountable, the steam-engine was invented, and accomplished all that could be desired. And when the frequent accidents from the explosion of gases made the miner tremble for his safety, the beautiful and ingenious instrument that forms the subject of this article, was produced. In No. VII. will be found an engraving and a discription of the Safety Lamp, or, as it is generally termed by the miners, in gratitude to the inventor, "the Davy." To that description we now add the following particulars:

In the month of August 1815, Sir Humphry Davy first turned his attention to the subject, and knowing how desirable it was to find some substitute for the naked candles with which the men had been in the habit of working, he first tried Kunkel's, Canton's, and Baldwin's phosphorus, and likewise the electrical light in close glass vessels, but without success. He then constructed a lamp with two valves, so contrived that the valves closed whenever the lamp was carried into an atmosphere contaminated with fire-damp; but it was found that this lamp could not be used in explosive atmosphere.

By subsequent experiments, he found that the fire-damp is light-carburetted hydrogen, or hydrogen gas holding carbon in solution; that it will not explode unless mixed with a portion of atmospheric air; that it explodes with most vehemence when mixed with seven or eight times its volume of air; that it retains its explosive power when mixed in the proportions of only one of gas to fourteen of air; and that when the atmospheric air is in greater quantity, the light of a taper merely becomes enlarged when brought within it, and that this effect is perceptible in a mixture of even thirty parts of air to one of gas. He found also, that the fire-damp is much less combustible than other inflammable gases; that it is not exploded by red-hot charcoal or red hot iron, though iron at a white heat will explode it; and that "on mixing one part of carbonic acid with seven parts of an explosive mixture of fire-damp, or one part of azote with six parts, their powers of exploding were destroyed."

In the prosecution of these inquiries he found that it was difficult to explode the mixture of air and fire-damp in small

Digitized by Google

tubes; and that in tubes of only one-seventh of an inch in diameter, and open to the atmosphere, it could not be inflamed, and especially if the tubes were metallic.

In reasoning upon these various phenoemena it occurred to him, as a considerable heat was required for the inflammation of the fire-damp, and as it produced, in burning, comparatively a small degree of heat, that the effect of carbonic acid and azote, and of the surfaces of small tubes in preventing its explosion, depended upon their cooling powers,—upon their lowering the temperature of the exploding mixture so much that it was no longer sufficient for its continuous inflammation.

This idea led to an immediate result:—the possibility of constructing a lamp, in which the cooling powers of the azote and carbonic acid formed by combustion, or the cooling powers of the apertures through which the acid entered or made its exit, should prevent the communication of explosion.

"I made," says Humphry Davy, "several attempts to construct safety-lamps which should give light in all explosive mixtures of fire-damp; and after complicated combinations, I at length arrived at one evidently the most simple,—that of surrounding the light entirely by wire gauze, and making the same tissue feed the flame with air and also emit light."

"In plunging a light," continues he, "surrounded by a cylinder of fine wire gauze into an explosive mixture, I saw the whole cylinder become quietly and gradually filled with flame; the upper part of it soon appeared red-hot, yet no explosion was produced.

"It was easy at once to see, that by increasing the cooling surface in the top, or in any other part of the lamp, the heat acquired by it may be diminished to any extent; and I immediately made a number of experiments to perfect this invention, which was evidently the one to be adopted, as it excluded the necessity of using glass or any fusible or brittle substance in the lamp, and not only deprived the fire-damp of its explosive powers, but rendered the inflammable gas itself an useful light."

Omitting the detail of other experiments, it was found that iron wire gauze, composed of wires from one-fortieth to one-sixtieth of an in inch in diameter, and containing twenty-eight wires or seven hundred and eighty-four apertures to the inch, was safe under all circumstances; and this material Sir Humphry Davy was therefore induced to adopt for the construction of lamps for coal-mines.

*(To be continued.)*

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus—Monday evening, Jan. 9, at seven o'clock, D. Ritchie, on Voltaic Electrcity.—Thursday afternoon, Jan. 12, at one, Mr. Sheridan Knowles, on the Drama.

*London Mechanics' Institution*, Southampton-buildings, Chancery-Lane.—Wednesday, Jan. 11, at half-past eight, E. Cowper, Esq., on Engraving by Machinery.—Friday, 13, Dr. Birkbeck, on Osteology.

*Western Literary and Scientific Institution*, 67, Leicester-square.—Thursday, Jan. 12, at half-past eigh: on Weaving.

*Society of Arts*, Adelphi.—Tuesday evening, Jan. 10, the Secretary, on the Metallurgical History of Iron.

*Islington Literary and Scientific Society.*—Thursday, Jan. 12, at eight o'clock, Mr. H. Goadly, on Insects, illustrated by the oxygen-hydrogen Microscope.

*Mutual Instruction Society*, Southampton Coffee House, Chancery-lane.—Essay on the Question, "Is it consistent with the nature of man that he should work more than 10 hours a day?"

### QUERY.

The best mode of extracting glass stoppers?—F.

### TO CORRESPONDENTS.

*Mr. John Gregory's" paper on an improvement in Balloons, in our next.*

*A Journeyman Mechanic" shall be answered at length very shortly.*

*A Subscriber. We intend to give an article on the subject.*

*Mr. Wivell. What would be the probable expense? and where can the machine be viewed?*

*Mr. Rough's paper in a No. or two.*

*S. T. C. The article shall be inserted the first opportunity.*

*J. L. The London Magazine, published by Fox, 67, Paternoster Row, will afford him the information required.*

*All Letters and Books for Review should be addressed "To the Editor," at the Publisher's, post paid.*

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

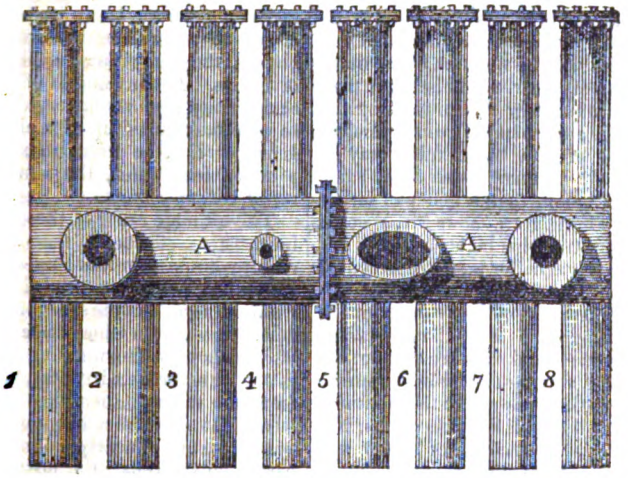
Digitized by Google

# THE PENNY MECHANIC.

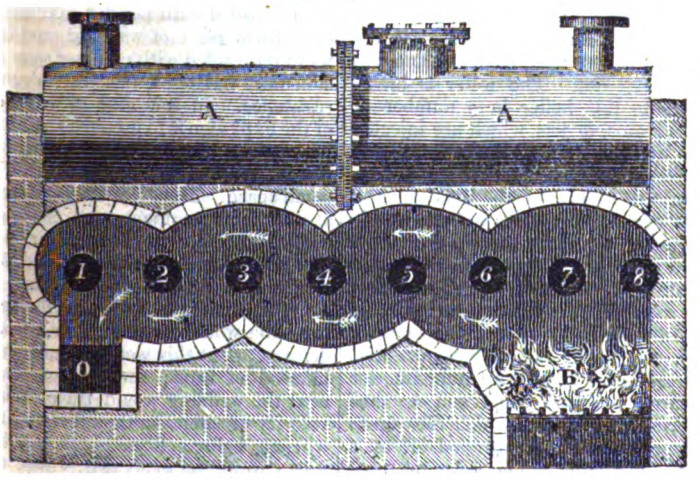
A MAGAZINE OF THE ARTS AND SCIENCES.

No. XI.] JAN. 14, 1837. [Vol. I.


WOOLF'S BOILER.




WOOLF'S FURNACE.







Holloway Press: D. A. Doudney.



Digitized by Google

### THE STEAM BOILER.

In our front page we present our readers with an engraving of Mr. Woolf's steam boiler, consisting of a series of cast-iron tubes, connected by means of screw bolts with the under side of a large vessel A A, which communicates with the engine.

One of the apertures in the upper, or principal boiler, A A, is intended for the admission of water, to supply the waste arising from evaporation, and the others point out the situation of the man-hole and safety-valves. This boiler possesses the advantage of diminishing the danger to be apprehended from explosion, as a series of gun barrel tubes may be made much stronger with the same quantity of metal, than a boiler of larger capacity. The diagram shows Mr. Woolf's method of setting his boiler as follows:

The principal boiler is still represented at A A, and the figures 1, 2, 3, &c. refer to the corresponding tubes in the previous diagram. B is the fire-place, O the chimney, and the arrows point out the long and waving course of the smoke and flame in their passage to the chimney.

In the Philosophical Transactions, No. 461, there is an account of a new way of producing steam of more than ordinary pressure. The boiler consists of an inverted conical vessel of iron, to the base or upper part of which a close and strong copper head or hemisphere is joined by rivets all round: the lower part, or cone, is set in a reverberatory furnace, to receive a sufficient heat from the flame to make it red hot. The water is introduced into this boiler in a number of small streams, or jets, which are injected into it by a pipe, which descends through the cover, or spherical top, of the boiler; and in the middle of the cone several spouts are fixed, radiating from it like the arms of a wheel: the pipe must be carried above the boiler, so as to have a column of a sufficient height to overcome the pressure of the steam, and also enter into the boiler with a considerable force; and by the radiating spouts it is dispersed into a shower upon the interior surface of the iron cone, and is thus converted into steam, which flies up to the copper head, and is carried off by a pipe to the engine. The inventor proposed to make the tube with the radiating spouts to revolve, for the purpose of distributing the water more completely.

### EFFECTS OF GUNPOWDER, WITH DIFFERENT CHARGES IN A GUN.

If a gun is loaded with ball it will not kick so much as when loaded with small shot; and amongst different kinds of shot, that which is the smallest, causes the greatest recoil against the shoulder. A gun loaded with a quantity of sand, equal in weight to a charge of snipe-shot, kicks still more. If, in loading, a space is left between the wadding and the charge, the gun either recoils violently, or bursts. If the muzzle of a gun has accidentally been stuck into the ground, so as to be stopped up with clay, or even snow, or if it be fired with its muzzle plunged into water, the almost certain result is that it bursts.

The ultimate cause of these apparently inconsistent effects is, that every force requires time to produce its effects; and if the time requisite for the elastic vapour within to force out the sides of the barrel, is less than that in which the condensation of the air near the wadding is conveyed in sufficient force to drive the impediment from the muzzle, then the barrel must burst. It sometimes happens that these two forces are so nearly balanced that the barrel only swells; the obstacle giving way before the gun is actually burst.

The correctness of this explanation will appear by tracing step by step the circumstances which arise on discharging a gun loaded with powder confined by a cylindrical piece of wadding, and having its muzzle filled with clay, or some other substance having a moderate degree of resistance. In this case the first effect of the explosion is to produce an enormous pressure on every thing confining it, and to advance the wadding through a very small space. Here let us consider it as at rest for a moment, and examine its condition. The portion of air in immediate contact with the wadding is condensed; and if the wadding were to remain at rest, the air throughout the tube would soon acquire a uniform density. But this would require a small interval of time; for the condensation next the wadding would travel with the velocity of sound to the other end, from whence, being reflected back, a series of waves would be generated, which, aided by the friction of the tube, would ultimately destroy the motion.

But until the first wave reaches the

Digitized by Google

impediment at the muzzle, the air can exert no pressure against it. Now if the velocity communicated to the wadding is very much greater than that of sound, the condensation of the air immediately in advance of it may be very great before the resistance transmitted to the muzzle is at all considerable; in which case the mutual repulsion of the particles of air so compressed, will offer an absolute barrier to the advance of the wadding.

If this explanation be correct, the additional recoil, when a gun is loaded with small shot or sand, may arise in some measure from the condensation of the air contained between their particles; but chiefly from the velocity communicated by the explosion to those particles of the substances in immediate contact with the powder, being greater than that with which a wave can be transmitted through them. It also affords a reason for the success of a method of blasting rocks by filling the upper part of the hole above the powder with sand, instead of clay rammed hard. That the destruction of the gun barrel does not arise from the property possessed by fluids, and in some measure also by sand and small shot, of pressing equally in all directions, and thus exciting a force against a large portion of the interior surface, seems to be proved by a circumstance mentioned by Le Vailant and other travellers, that, for the purpose of taking birds without injuring their plumage, they filled the barrel of their fowling-pieces with water, instead of loading them with a charge of shot.

## OXYGEN NECESSARY FOR COMBUSTION.

The necessity for the presence of oxygen in the more familiar cases of combustion is so clearly exemplified in a certain operation on cotton goods, called singeing, and has been contrived for the purpose of taking off all the ends of the threads and other downy filaments that are usually attached to the piece, and of giving the whole a smooth surface.

To effect this, several pieces of calico, previously fastened together by their ends, are lapped smoothly round a large wooden roller, from which, by a regular motion, they are passed over a large semi-circular piece of cast iron, which, by means of a furnace placed immediately beneath it, is constantly kept at a full red heat.

Calicoes, muslins, dimities, fustians, &c. are treated in this manner, and the subsequent bleaching takes out any stains which they may have contracted from the iron.

To a stranger, this may seem a very destructive operation (and no one can witness it for the first time without astonishment); but by the quickness and regularity of the motion, and by the uniform pressure of the cloth upon the hot iron, the combustion that would otherwise take place is prevented, and nothing is burnt but the loose threads that rise above the surface of the fabric. The peculiar effect that is here produced, and how the cloth is protected from the red-hot metal, may be thus explained.

The uniform pressure of the cloth upon the heated cylinder, keeps that part of it which is directly over it in close contact, so that there is no space for the intervention of any more atmospheric air than is just sufficient to occasion the combustion of the mere superficial filaments of the cotton or linen: and this is the only effect which the manufacturer is desirous of producing.

## THE HUMAN BODY.

### THIRD ARTICLE.

In our last paper, the general material properties of the blood were described. We have now to consider its more important qualities; those which it presents as a vital fluid. The blood in all ages has been regarded as the most important fluid of the body, even before its common properties were known, before its chemical constitution had been ascertained or its circulation discovered, before indeed any thing more was known respecting it, than what an attentive observer, though not an anatomist, may be supposed to be familiar with in the present day, the blood was always considered to be mysteriously connected with animal life.

The popular opinion, respecting the vitality of the blood, was for a long time disregarded by physiologists, who considered this fluid but little more

Digitized by Google

important than any of the fluids of the body. Dr. Hunter, however, by a series of well-conducted and very interesting experiments, proved that the blood was distinguished from every other fluid by its possessing life. Some of the peculiarities attendant upon this attribute, we are now about to describe.

The blood of our bodies is contained in and circulated through a series of tubes, distributed to every part and varying in diameter from a size quite unappreciable to that of the large artery which has its commencement in the heart itself. Now it is obvious that if some of these vessels were divided by a sharp instrument, so that the blood was allowed to escape from them, it would soon all flow from the body, even on the slightest wound, unless nature provided a means by which the hæmorrhage or flow of blood could be stopped. This is effectually accomplished by the blood itself. No sooner does it quit the vein or artery, in which it has been circulating, than it undergoes an imperfect change; it coagulates, it thickens, and thus clogs up the end of the vessels from which it may be issuing, so that any further loss is entirely prevented. Every one must have observed this when they have accidentally made an incision into the skin: in the larger arteries of the body, however, hæmorrhage is not stopped by this means, because the force of the current of blood sent from the heart prevents the adhesion of the cut end of the artery.

It has been found by numerous experiments, that nothing can prevent the blood coagulating when once it quits the living vessel in which it has been circulating. To explain the change which takes place, we will suppose a basonful of blood has been allowed to flow from a person's arm, as in the ordinary operation of bleeding. If this blood be attentively watched, at the expiration of about ten minutes it will be found to have changed from a red, glutinous, homogenious fluid into a solid and a fluid,—a clot of a red colour floating in a fluid, which, after a short time, will be nearly white. This effect is produced under all circumstances. If the blood be frozen immediately it is taken from the body, it will be found coagulated when it is thawed. If it is heated to a temperature much above that which it maintains in the body, the same effect takes place. If it be kept at rest, or in violent action, still it coagulates. Indeed, the best way to obtain a good clot for examination, is to keep the blood in action with a piece of besom as it flows from the animal.

In order to ascertain whether coagulation could not be prevented if an artificial circulation was kept up,—the blood being maintained at its ordinary temperature, 98°—it has been made to circulate, under these circumstances, through blood-vessels taken from the body of a dead animal—still the blood coagulated. The cause of this surprising phenomenon can only be explained, with any degree of satisfaction, by the theory which supposes that the blood is alive; that it has a natural tendency to coagulate, but that this change is prevented by its possessing life; and that consequently, as soon as the blood is removed from the body, or its circulation impeded, so that its vitality is destroyed, it can no longer resist the tendency to coagulate, which effect is consequently produced. That the blood is alive while within the body, and possesses different properties to the other fluids, such as saliva, or dymph, may be proved, we think, satisfactorily, from a variety of sources. It has the power of resisting, within certain limits, the influence of the ordinary laws which govern matter:—for instance, Hunter found that it could resist the effect of cold for a certain time, the same as an egg, containing the living principle, can. He found that after the blood had once been frozen it could be frozen a second time, at a less degree of cold than the first time; and a third time with a less degree of cold than the second; thereby showing that the vital principle had been affected by the previous process. Hunter also proved that it must itself be alive, because it would unite living parts, which dead matter could not do. When a bone is broken, the blood effused between the broken ends soon has a number of blood-vessels sent into it, which deposit fresh bone, and remedy the injury that has taken place. Hunter says very posi-

Digitized by Google

tively, that vessels actually originate from within the clot itself. From these facts it is concluded that the blood must possess life, or living vessels would not be sent into it. He also performed a variety of experiments on fowls, such as removing a living portion from one and sewing it up in the abdomen of another, when the part adhered and became a part of the latter. These experiments also showed that the blood must possess vitality, and in a future paper we will describe the effects that are produced when it dies.

## PRESSURE OF THE ATMOSPHERE.

*To the Editor of the Penny Mechanic.*

Sir,—On the surface of our earth there exists an invisible elastic fluid, commonly denominated the atmosphere, or air, without which it would be utterly impossible for animal life to be sustained. It has been calculated to extend to a distance of about forty-five miles from the surface of the earth, its density being different at different altitudes, it becomes more rarified as its distance from the earth increases. It is a material substance, therefore must possess a weight, which acts with a certain degree of pressure on all bodies exposed to it, whether solid or fluid; and which pressure is estimated to be equal to about fifteen pounds on every square inch of surface; that is, a column of air, forty-five miles high and one inch square, will weigh 15lbs.

Many people imagine that the air is void of any pressure because they have no sensation of it; but the reason of this is very clear, for the pressure of the air, with respect to our bodies, acting both externally and internally, the pressure is counterpoised, which renders it insensible. But the pressure of the atmosphere is manifest in many instances. Close a pair of bellows, so as to force the air out of them, then stop the nozle and valve-hole, and it will be found that to separate their sides, a force of some hundreds of pounds will be required, which is owing to the external pressure of the atmosphere. Fill a glass tube, which is about thirty-four inches in length, and closed at one end, the bore of the tube being sufficiently large to prevent any sensible effect by "capillary attraction," with mercury; insert it into a small vessel containing some of the same fluid, and the mercury in the tube will descend from the upper part of the tube and remain suspended at an altitude of between twenty-eight and thirty-one inches from the surface of the mercury contained in the vessel, it being supported by the pressure of the air on the external opening of the hole, the various altitudes of the mercury indicate the amount of the pressure. This simple instrument is called a "barometer," by which the elasticity or pressure of the air is estimated. Now if the air possessed no weight, how is it possible for the mercury in the tube to be supported? for by putting the barometer under the receiver of an air-pump, and exhausting the air out of the receiver, the mercury in the tube will fall till it is level with that in the vessel, the pressure of the air no longer acting on it. It was partly by the pressure of the air that Newcomen's steam-engine, which is more generally known by the name of the "atmospheric engine," was made to work, the cylinder of the engine being open at the top, so that the upper surface of the piston was exposed to the pressure of the air, which, as soon as the steam below the piston was condensed, by means of a jet of cold water, forced the piston down.

S. T. C.

## SHIPWRECKS.

*To the Editor of the Penny Mechanic.*

Sir,—In all sea-going vessels, when expense in the outfit is not of materia consideration, the provision, cargoes, and lives of crews and passengers can be saved, from ships that are water-logged, and safely brought into port, even if the vessel be consigned to the remotest part of the globe.

The limits of your paper will not allow me fully to explain the various plans that can be acted on by all the commercial nations in the world, for carrying the above plans into execution, in every craft, from the Thames wherry to the British 120-gun ship; but, so far as I know, no one, except myself, has ever yet thought of the perpendicular stowage of vessels. But it is by this peculiar stowage that the above

Digitized by Google

plans can and will be carried into execution.

1st. Let us imagine that in a seventy-four-gun ship there is one or many iron cylinders, or oblong wooden cases, rising perpendicularly from the keel, through all the decks, to from four to six feet above the upper deck; that the carlines and beams of the ship are placed at such distances, that these cylinders, or cases, can be bolted to them; and that the projection outside the cylinders, or cases, at the bottom of them, can be bolted to the keel and bottom of the vessel; and that the sides of these cases are sufficiently strong to prevent them from being broken or dinged by the usual accidents that might happen on board.

2nd. Let cases be made, water-proof and strong as a beer-but, to fit, without loss of room, in these perpendicular cases. Let the internal cases be made of cast metal, or sheet iron, or wood; and let there be at least one inch clear between all parts of the inside of the outer case and the outside of the inner case. Let there be eye-bolts at the corners, or sides of the internal cases; and let five fathoms of half or three-quarter-inch, be spliced into each eye-bolt: then lower away the first case, which we will suppose to be five-sixths, or seven-eighths full of water (for every case must be a little less weight than an equal bulk of sea-water). Splice the four ends of the ropes to the eye-bolts in the next case, and lower away. Continue this until your cylinder, or perpendicular cases, are all full of provisions; then, in case the vessel fills, and should the ship go down, provided that these cases are clear of the ship's rigging, the uppermost case of provisions will first float, the next to it in succession, until the whole rise, and come within reach of the crew. But if the ship does not go down, and if the water, provisions, &c. are in one case, in different parts of it, in daily allowances for the crew, they can get at these things much easier than they now can in any ship, because there will be no stowing and re-stowing required.

I am your obedient servant,

M. Rough.

---

## PHOSPHORESCENCE OF THE SEA.

*To the Editor of the Penny Mechanic.*

Sir,—In No. VIII. of your Magazine is an account of the luminous appearance of the sea, and its probable cause. I beg to offer you the following extract from the "Companion to the Almanac," of 1830.

"Captain Horne, R. N., in a paper addressed to the 'Quarterly Journal of Science,' communicates the discovery that the cause of the brilliant light observed in the *sea-weed* thrown on the beach of Laucing, on the coast of Sussex, is the animalculæ (satularia volubills) of Elis, described by him in his 'Caralllines and Zoophytes (the clytia volubilis) of Lamouroux,' but not mentioned to be luminous.

"On the 8th of December, and the following days, a great quantity of weed had been thrown up by a hard-blowing south-west wind, so that the beach was covered with it to more than two feet deep in many places. After dark a small quantity was collected of the most brilliant, and this was always found to be that which had been left at the first of the ebb, and was only moist rather than that which had been just washed up. Picking out a single spark, and removing from it every extraneous matter, Capt. Horne ascertained, by the aid of a microscope, that the light was caused by the insects adhering to the sea-weed. The light would remain sometimes steady for about five seconds, often less, and when it ceased was renewed by touching it with the finger. In a darkened room, by day, no light whatever was emitted, yet the same weed, kept till the evening, was as brilliant as any that had been found." I am, yours truly,

J. L.

---

## ECONOMIZING LABOUR.

The fatigue produced on the muscles of the human frame does not altogether depend on the actual force employed in each effort, but partly on the frequency with which it is exerted. The exertion necessary to accomplish every operation consists of two parts: one of these is the expenditure of force which is necessary to drive the tool or instrument; and the other is the effort required for the motion of some limb of the animal producing

Digitized by Google

the action. In driving a nail into a piece of wood, one of these is lifting the hammer, and propelling its head against the nail; the other is, raising the arm itself, and moving it in order to use the hammer. If the weight of the hammer is considerable, the former part will cause the greatest portion of the exertion. If the hammer is light, the exertion of raising the arm will produce the greatest part of the fatigue. It does therefore happen, that operation requiring very trifling force, if frequently repeated, will tire more effectually than more laborious work. There is also a degree of rapidity beyond which the action of the muscles cannot be pressed. The most advantageous load for a porter who carries wood up stairs on his shoulders has been investigated by M. Coulomb; but he found from experiment that a man walking up stairs without any load, and raising his burden by means of his own weight in descending, could do as much work in one day, as four men employed in the ordinary way with the most favourable load. The proportion between the velocity with which men or animals move, and the weights they carry, is a matter of considerable importance, particularly in military affairs. It is also of great importance for the economy of labour, to adjust the weight of that part of the animal's body which is moved, the weight of the tool it urges, and the frequency of repetition of these efforts, so as to produce the greatest effect. An instance of the saving of time by making the same motion of the arm execute two operations instead of one, occurs in the simple art of making the tags of bootlaces: these tags are formed out of very thin, tinned, sheet-iron, and were formerly cut out of long strips of that material into pieces of such a breadth that when bent round they just enclosed the lace. Two pieces of steel have recently been fixed to the side of the shears, by which each piece of tinned-iron as soon as it is cut is bent into a semi-cylindrical form. The additional power required for this operation is almost imperceptible; and it is executed by the same motion of the arm which produces the cut. The work is usually performed by women and children; and with the improved tool more than three times the quantity of tags is produced in a given time.

## WINDOW GLASS.

The effect of great velocity in modifying the form of a cohesive substance is beautifully shown in the process for making window-glass, termed "flashing," which is one of the most striking operations in our domestic arts. A workman having dipped his iron tube into the glass pot, and loaded it with several pounds of the melted metal, blows out a large globe, which is connected with his rod by a short thick hollow neck. Another workman now fixes to the globe immediately opposite to its neck, an iron rod, the extremity of which has been dipped in the melted glass; and when this is firmly attached, a few drops of water separate the neck of the globe from the iron tube. The rod with the globe attached to it is now held at the mouth of a glowing furnace: and by turning the rod the globe is made to revolve slowly, so as to be uniformly exposed to the heat: the first effect of this softening is to make the glass contract upon itself and to enlarge the opening of the neck. As the softening proceeds, the globe is turned more quickly on its axis, and when very soft and almost incandescent, it is removed from the fire, and the velocity of rotation being still continually increased, the opening enlarges from the effect of the centrifugal force, at first gradually, until at last the mouth suddenly expands or flashes out into one large circular sheet of red-hot glass. The neck of the original globe, which is to become the outer part of the sheet, is left thick to admit of this expansion, and forms the edge of the circular plate of glass, which is called a "Table." The centre presents the appearance of a thick boss or prominence, called the "Bull's-eye," at the part by which it was attached to the iron rod.

## AEROSTATION.

*To the Editor of the Mechanic.*

Sir,—As the science of aerostation has of late, but more particularly during the last summer, excited very generally the interest of the public, perhaps the following may not prove altogether uninteresting to your readers. Having for some months past devoted considerable attention to the science, and observing the many insurmountable difficulties attending the bal-

Digitized by Google

loon now in use, I have been led to invent apparatus to obviate these difficulties; and it gives me great pleasure to inform you, that I have been perfectly successful, having no doubt in my own mind—and many gentlemen are of my opinion—that my apparatus will entirely supersede the use of gas for inflating the balloon. I now flatter myself I have fulfilled Dr. Darwin's prophecy:

Soon shall thine arm, unconquer'd Steam,
Drag the slow barge and urge the rapid car,
Or on wide waiving wings expanded bear
The flying chariot through the fields of air.

The following difficulties attending the gas balloon are allowed to exist, by every person who has at all entered into the study of aerostation:—

1st, The aeronaut is made to ascend by discharging ballast, and descend by allowing gas to escape, thereby doing away with the ascending power.

2ndly, By the heat of the sun and the diminished density of the atmosphere—though the first acts but slightly in comparison to the latter, for the farther you get from the earth the more you lose the sun's heat, but then you have to contend with the more powerful opponent, the rarified air—by which means the gas is made to expand, thereby endangering the bursting of the balloon, and also doing away with the possibility of entirely inflating it. The only resource to obviate this disadvantage is by allowing gas to escape; this, however, counteracts the ascending power again, which is another insurmountable difficulty, which would render it impossible to continue in the air for any length of time, with sufficient supporting power to insure a steady descent; for the expanded gas would condense upon near approach to the earth, though the heat of the sun attracted by the earth would act in favour of the aeronaut.

3rdly, In crossing any body of salt water by the operation of it on the air decreasing its density, thereby requiring by far more supporting power, which Messrs. Blanchard and Jefferies would have been very glad to have availed themselves of when they crossed the channel in 1785.

4thly, The expense of inflating a balloon with even coal-gas, for a balloon containing 24,000 cubic feet, will cost 25*l.* for inflating. I will now proceed to point out the advantages an apparatus upon my construction will possess over gas.

1st, I can ascend and descend as often as I please without loss of power, thereby enabling me to take advantage of different currents of air which exist at different altitudes; with this control over the machine, it can be rendered by far more manageable than with gas.

2ndly, The heat of the sun will be an advantage rather than otherwise.

3rdly, In crossing a body of salt water, I should require more ascending power.

4thly, The expense of inflating a balloon with gas I said would be about 25*l.* but to render an apparatus upon my construction buoyant would not amount to 5*l.* I have only now to add that my circumstances at present will not allow of the capital required to get up an apparatus for me to make a practicable ascent, to prove the superiority of my invention over the gas balloon; for I would ascend and remain in the air for a week with the greatest confidence. In conclusion, I think, in thus making public my invention, through the medium of your Magazine, it may meet the view of some of your readers, who might be disposed, upon a proper arrangement between ourselves, to find the necessary capital to give it a practicable trial on a larger scale.

Your's obediently,
JOHN GREGORY.

No. 11, *Regent-st., City-road.*

## LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday evening, Jan. 19, at seven o'clock, Dr. Ritchie, on Voltaic Electricity.—Thursday afternoon, Jan. 19, at one, Mr. Sheridan Knowles, on the Drama.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Jan. 11, at half-past eight, E. Cowper, Esq., on Engraving by Machinery.—Friday, 13, Dr. Birkbeck, on Osteology.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Jan 12, at half-past eight, E. Cowper, on Calico Printing.

*Islington Literary and Scientific Society*.—Thursday, Jan. 19, at eight o'clock, Mr. H. Goadby, on Insects; illustrated by the oxygen-hydrogen Microscope.

*Mutual Instruction Society*, Southampton Coffee-House, Chancery-lane.—Thursday, Jan. 19, at half-past eight, a *Conversazione*.

## TO CORRESPONDENTS.

"Mr. Patterson." We are much obliged for the Communication. An Engraving shall be made from the model sent us, and inserted in a Number or two.

"J. R.'s" description is hardly explanatory enough. It appears to us, that in order to have the spokes within the cylinder air-tight; there must be considerable friction, *much* greater than that of a piston of an engine. This is an objection; but the plan, on the whole, certainly evinces much ingenuity; and if we can find a place for the paper shortly we will do so.

"National Baths," received with thanks.

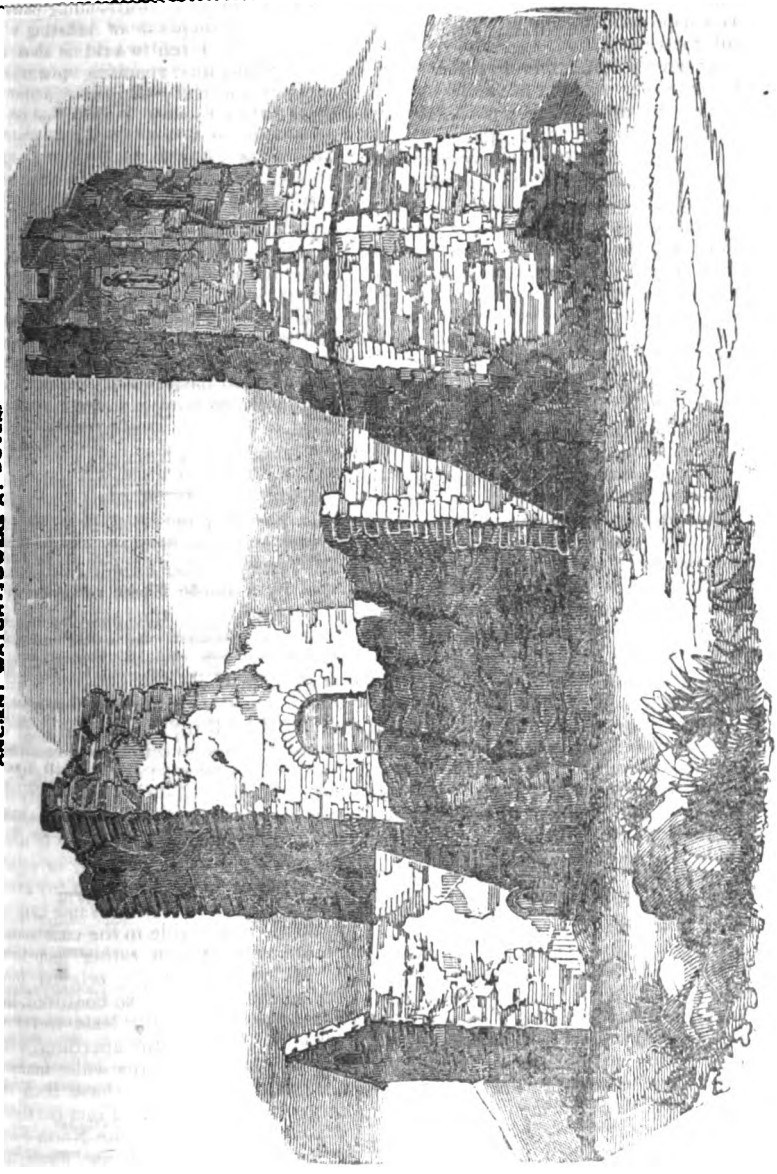
London: Printed at the Holloway Press, by D. A. DOUDNEY: published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC.

## A MAGAZINE OF THE ARTS AND SCIENCES.

No. XII.] JAN. 21, 1837. [Vol. I.



ANCIENT WATCH-TOWERS AT DOVER.



Holloway Press. D. A. Doudney.

Digitized by Google

### THE WATCH TOWERS OF DOVER.

Dover Castle which commands the town, is one of the most important fortresses in this part of our island. It is near the mouth of the Thames, and is an edifice of considerable antiquity. It was erected on the site of a British hill fortress.

It consists of an immense congeries of almost every kind of fortification by which the art of war has contrived to render a situation impregnable; though its consequence has been materially lessened since the invention and use of cannon; the eminences to the north-west by west, and south-west, being much higher than the site, even of the keep itself. The buildings are so numerous and complex, that a precise idea of their relative situations can hardly be obtained without the assistance of a ground plan. They occupy nearly the whole summit of the high eminence which bounds the south-eastern side of the deep valley in which Dover is built.

In a general way, this castle may be described as consisting of two courts, a lower one and an upper one, from which communications from the inner towers have been made by well-like subterraneous passages. The lower court is surrounded by an irregular wall, excepting on the side next the sea, where a considerable part of the cliff, with the remainder of the wall, was thrown down by an earthquake which happened on the 6th of April, 1680. This wall is called the curtain, and is flanked, at unequal distances, by a variety of towers of different shapes; the oldest of them, which is on the eastern side of the castle, is said to have been built by Earl Goodwin, and it still bears his name; though this, as well as most of the others, have been much altered since their original erection. Nine of the other towers are stated to have been built in the Norman times, and to have taken their name from Sir John de Fiennes, and the warriors whom he had selected to assist in the defence of this fortress.

Averanche's or Maunsel's Tower is a fine specimen of Norman workmanship, standing at an angle formed in this part by the curtain wall. Maunsel, who succeeded Averanche in the command of this castle, was Lord Warden of the Cinque Ports, in the reign of Henry VIII. The next is Veville or Vincester Tower, so called from its different commanders of those names. Further on is Ashfordian Tower, so named from lands near Ashford, which had been granted to keep it in repair; and beyond this, reaching towards the extremity of the wall near the cliff, are three other towers, two of which we give our readers a representation of, from a drawing taken on the spot. They are built with red Roman tiles, and are a striking piece of ancient architecture.

The upper court, like the lower one, is surrounded by a strong wall and several towers; and near the centre stands the spacious keep, erected in the reign of Henry III. The noble tower, called the Keep or Palace Tower, is constructed on a similar plan to those built by Bishop Gundulph, and is much like that at Rochester.

The present entrance is on the south, but its original entrance was on the east side, and it opened by a magnificent portal, now bricked up, into the grand apartments, which were on the third story. The ascent to this portal was by a noble flight of stone steps, commencing on the south side, and continued within a lesser adjoining tower, which flanks the south-east angle and whole east side. The staircase, besides other defences, was guarded by three strong gates, at different heights, and had two vestibules. In the thickest part of the walls, which measures from eighteen to twenty feet, run the galleries; these are so ingeniously contrived, as to render it nearly impossible for the arrows, or missive weapons of an enemy, to do any execution within them. The same cautious policy is observable in the construction of the windows, or rather loop-holes, which preserve their original form, where the arches are so contrived, that no arrow, having the least elevation, could be shot into the apertures, without striking against the wall; many of the original openings have been enlarged in later times. From the turret are seen the point of the North Foreland beyond the light-house, Ramsgate, Sandwich, and Dungeness light-house.

Digitized by Google

## LAW OF PATENTS.

We have been requested by several correspondents, at various times, to afford them some information regarding the law of patents, we now therefore take the opportunity of doing so.

The following requisite qualities of an invention, in order that it may become the subject of a patent, are stated by Holroyd, in his treatise "on the Law of Patents for Invention."

The invention for which a patent may be granted, must be a manufacture.

The manufacture must be—1st. New, as to its public use and exercise in England—2nd. It must be useful to the public.

A foreign invention, though practised abroad, may be the subject of a patent.

A manufacture discovered by a person, if not made known, will not prevent another person who discovers the same thing, from obtaining a patent for it.

A manufacture is not considered new if it be in use or known to the public at the time of granting a patent for it. As when taken from a book published in England.

If an invention consist of an improvement upon any thing, and that which constitutes the improvement be known, and has been before applied to a similar purpose, though not to the specific thing which the patentee has applied it to, it will not possess sufficient novelty to be the subject of a patent.

Manufactures according to the construction given to the Stat. 21. James I. chap. 3, may be divided into

1st. Things made.

2nd. Practice of making.

1st. *Of things Made.*—I. A thing made which is useful for its own sake, and vendible as such, or some part of such thing.—As, a medicine—telescope—watch, or a movement to a watch, &c.

II. A piece of mechanism, engine, or instrument for producing either old or new effects, by being employed to effect some useful purpose: or a new part of a machine, &c., whereby it is rendered more efficacious.—As a lace machine—steam engine or an improvement on machines.

2nd. *Practice of Making.*—Or principles carried into practice in a new manner; or new results of principles.

I. A mode of employing practically art and skill, producing an effect useful to the public, or an improvement on such modes—or an artificial manner of operating with the hand or with instruments in common use.—Hartley's patent for securing buildings from fire might come under this head; it was a new method of disposing iron plates in buildings.

II. A process or combination of processes in any art producing an effect useful to the public—or an improvement in a combination, &c.—As any chemical process—or an alteration of any known process by an addition of ingredients, &c.

*Of the Person to whom, and for what time a Patent may be granted.*

A Patent may be granted to a person for a discovery communicated to him by another if not previously made public.—As in Dolland's patent for making object glasses; Dr. Hall had given the necessary information to Dolland. So with information gained abroad, if not previously known in England.

The time for which a patent may be granted is limited by Sec. 6, of 21 James I. cap. 3, to fourteen years or under, and the duration of the term can only be extended by act of parliament.

As the business of preparing the specification, and obtaining the patent, is almost always performed by an attorney, we do not think it necessary to describe the manner of accomplishing this. The time engaged in passing the patent is generally about two months; and it may be proper to mention, that a patentee who wishes to secure to himself the benefit arising from the use of his invention in Scotland, or Ireland, must take out separate patents for those countries, besides the English patent.

The following abstract of the Act 5 and 6 Will. IV. c. 83, relating to letters patent, contains some important information to inventors.

Sect. 1, Recites that it is expedient to make certain additions to and alterations in the present law touching letters patent for inventions, as well for the better protecting of patentees in their rights, as for the more ample benefit of the public: enacts that any person having obtained letters patent for any invention may enter with the clerk of the patents of England, Scotland, or Ireland, respectively, as the case may be, having first

Digitized by Google

obtained the leave of his Majesty's attorney-general or solicitor-general in case of an English patent, of the lord advocate or solicitor-general of Scotland in the case of a Scotch patent, or of his Majesty's attorney-general or solicitor-general for Ireland in the case of an Irish patent, certified by his fiat and signature, a disclaimer of any part of his specification, or a memorandum of any alteration therein, not being such as shall extend the exclusive right granted by the said letters patent; and which, when filed, shall be deemed part of such specification; but a caveat may be entered as heretofore; and such disclaimer shall not affect actions pending at the time; and the attorney-general may require the party to advertise his disclaimer.

2. Where a patentee is proved not to be the real inventor, though he believed himself to be so, he may petition his Majesty in council to confirm his letters patent or grant new ones; and the said petition shall be heard before the judicial committee of the privy council, who, on being satisfied that such patentee believed himself to be the first and original inventor, and that such invention had not been generally used before the date of such first letters patent, may report their opinion that the prayer of such petition ought to be complied with, whereupon his Majesty may, if he think fit, grant such prayer; but any person opposing such petition shall be entitled to be heard before the said judicial committee: and any person, party to any former suit touching such first letters patent, shall have notice of such petition.

3. If in any action or suit a verdict or decree shall pass for the patentee, the judge may grant a certificate, which being given in evidence in any other suit shall entitle the patentee, upon a verdict in his favour, to receive treble costs.

4. Allows a patentee, on advertising as therein mentioned, to apply to the privy council for a prolonged term. If the judicial committee report in his favour, his term may be prolonged for seven years; but such application must be made before the expiration of the original term.

5. In case of action, &c., notice of objections to be given with the pleadings.

6. Costs in actions for infringing letters patent, to be given as either party has succeeded or failed in any part of his case, without regard to the general result of the trial.

7. Penalty for using, unauthorized, the name or device of a patentee, &c. 50l. one half to his Majesty and the other to any informer.

["A journeyman mechanic" who wrote to us a short time since, to know "how he might prevent capitalists who should make offers to assist him, and having by that means obtained a sight of his invention, endeavour to deprive him of the benefit of it," will see by the foregoing that even if the attempt were made it could not be successful, as the patentee must swear that, to the best of his knowledge, he is the first and true inventor, or that the invention has been communicated to him by a foreigner. "A journeyman mechanic," may therefore, we think, without fear, endeavour to obtain the assistance of those who are willing to support him in his application for a patent.]

## OIL GAS.

THE gas employed to illuminate the streets of the metropolis, and the various buildings and shops that use it, is produced from coals; but a very brilliant light, superior in many respects to that from the combustion of this gas, may be procured from oil gas. It possesses many advantages over the gas generally used. It is said that it can be prepared from oils which could not be used in lamps; it does not contain sulphurated hydrogen or other matter by which it is contaminated, and there are no objections to its use in close rooms, as it has no suffocating smell. It does no sort of injury to furniture, pictures, &c., and the costly and offensive operation of purifying the gas by lime is totally avoided when it is obtained from oil. Nothing is contained in oil gas which can injure the metal of which the conveyance pipes are made. The oil gas contains no unmixed hydrogen, which occasions the great heat of coal gas, for there is no greater heat in proportion from the flame of oil gas, than from burning oil in lamps. The apparatus for the production of this gas is also very much less expensive than that required for coal gas, besides being much more simple, as we shall directly explain.

Digitized by Google

The reason oil gas is not generally used is, we presume, because it is thought that if a great quantity was required to be made, the price of oil would so much increase, that the process could not be carried on so economically as it can be from using coals. As, however, the gas can be very easily made in private houses, and as some of our correspondents have requested a little information on the subject, we give the following particulars.

Messrs. J. and P. Taylor were the first persons who resorted to oil as a substance from which gas for illumination could be cheaply and easily prepared, and the apparatus they employed for the purpose was extremely simple. The retort was formed of a bent cast-iron tube, which was heated by a small convenient furnace, and oil was allowed to drop slowly into the tube, from a vessel above it. The oil was immediately volatilized, and the vapour in traversing the tube became perfectly decomposed. A mixture of inflammable gases, which contain a great portion of olefiant gas, passes off; the gas was washed by being passed through a vessel of water which dissolves a little sebacic acid, and seldom required changing, and it was then conducted into the gasometer. The washer and gasometer of Messrs. Taylor are particularly deserving notice. In the washer, two planes are fixed in a box or cistern, in a direction not quite horizontal, but inclined a little in opposite directions; the planes are traversed nearly across by slips of wood or metal, fixed in an inclined position on the under surface, and which alternately touch one side of the cistern, leaving the other open and free. These planes being immersed in water, the gas is thrown in under the lower ridge, and by its ascending power is made to traverse backward and forward along the ridges fixed on the planes until it escapes at the highest part of the uppermost ridge. Thus with a pressure of six inches of water only, it is made to pass through a distance of fourteen or sixteen feet under the surface of the fluid, and become well washed. The smaller gasometers are made of thin plate iron, and being fixed in a frame of iron work, look more like ornamental stoves than the bulky appendages to gas apparatus, which they supply. The larger ones are made very light, and when in pieces, very portable, by being constructed of a frame of wood work, in the edges of which are deep narrow grooves; plates of iron fit into these grooves, which being caulked in and painted over, make a tight and light apparatus. These are easily put together in any place, and may therefore be introduced into a small apartment or other confined space where a gasometer already made up would not enter.

From the above description those who wish to manufacture oil gas for their own use, will probably understand something of the method of doing so. It is only necessary to have an iron tube bent at one end, or of a semicircular form, kept at a red heat; oil must then be allowed to drop into the tube from a vessel placed above it, (the quantity can of course be regulated by a stop-cock) and the oil will be decomposed in the tube, and pass out at the other end as gas. This must be allowed to circulate through water if it is wished to have the gas in a state of purity; but if this is not important, it is merely necessary to have a receiver in order to have a regular supply of gas to the burner. The light procured from gas obtained in this manner will be found far superior to that given out by lamps, and the quantity of oil consumed will be considerably less. One gallon of common whale oil will produce about ninety cubic feet of gas, and an argand burner will require a cubic foot and a half per hour to maintain a perfect light; consequently, a gallon of oil, made into gas, will afford such a light for sixty hours, and the expense, at a moderate price of oil, will be, allowing for coals, labour, &c., not more for one burner than three farthings per hour. Such a burner will also be equal in intensity of light to two Argand oil lamps, or to ten mould candles. One cubic foot of oil gas, will also go as far as four of coal gas, in consequence of its containing a greater quantity of olifiant gas, the gas from which artificial light, whether of candles, oil, or gas, is produced.

As our readers, if they manufacture any of this gas, will probably only make a small quantity, we do not anticipate that they will experience difficulty from the disarrangement of any part of the

Digitized by Google

simple apparatus. Messrs. Taylor found, however, that after a certain time the tube would not decompose the oil so perfectly as it did at first, and they discovered that a few pieces of broken bricks introduced into the retort or tube greatly increased its decomposing power, from presenting a greater surface for the fire to act upon. In a small tube we dare say that an occasional cleaning to remove the carbon that accumulates will be quite sufficient.

## OBJECTS OF CHEMISTRY.

CHEMISTRY is the science which makes known to us the properties of the component particles of all natural bodies. We speak not only of those compound particles which are the result of organization, but of the ultimate, indivisible, or elementary particles. It treats of the infinitely various sorts of substances, and of the exact determination of their differences. It exhibits the means by which the component parts of compound bodies can be separated from one another, or by which the elements of compounds can be made to combine together. In fine, it shows by what contrivances the corpuscles which constitute the world, can be most beneficially applied to the service of man.

The objects of chemistry are inexhaustible. It undertakes the examination of all substances which act upon the senses. It seeks to determine the properties of those substances, the number and proportion of their component particles, the individual nature of those components, and the properties of all other compounds which can be produced by their combination, either in different numbers or in different proportions. There are no bounds to the researches of chemistry; because, at whatever point its operations commence, there is no telling to what they may lead. Indeed, so infinitely varied are its objects, that it is an everlasting source of occupation and amusement; and while, on this account, it receives the attention of the curious philosopher, it claims the notice of all men, from its utility in the arts by which the comforts and existence of civilized life are promoted and supported.

The great mportance of the science of Chemistry is rendered evident by the following considerations.—It is useful in explaining natural phenomena; and in acquiring a knowledge of the constitution of the atmosphere, in investigating the changes to which it is subject, the variations of temperature, the laws of winds, dew, rain, hail, and snow, Chemistry is our principal, our only satisfactory guide. These remarkable changes in the face of nature—changes which, because familiar, do not produce any emotion in the mind, though in themselves truly wonderful—are chemical operations on a magnificent scale, and can only be explained by chemical laws.

In man's researches into the nature of the things whence he derives the means of his comfort, his happiness, his luxuries, and even his existence—in examining the various objects which compose the mineral, the vegetable, and the animal kingdoms, Chemistry is essentially requisite for the successful progress of his inquiries.

In considering the application of Chemistry to the improvement of the arts of civilized life, a wide field of contemplation opens to our view. So extensive, indeed, are its influence and importance, that, in most of the arts, many of the processes—in some all that are employed—depend on chemical principles. The bare mention of some of these arts will suggest ample illustrations of its extensive utility.

In the medical art, of so great service is a knowledge of Chemistry, that it is now universally regarded as an essential branch of a medical education. In the art of extracting metals from their ores, in purifying and combining them with each other, and in forming instruments and metals—whether for useful or ornamental purposes—almost all the processes are purely chemical. The arts of glass and porcelain making, of tanning, soapmaking, dyeing, and bleaching, depend entirely upon chemistry; and in all the processes in baking, brewing, and distilling, most of the culinary arts, and many other processes in domestic economy, are chemical operations. In short, wherever, in any of the processes of nature or of art, the accumulation or the diminution of heat takes place—wherever substances in

Digitized by Google

combination are to be separated—wherever the union of simple substances and the formation of new compounds are effected;—the operations and their results can only be explained on chemical principles.

From the general view of the extensive application of chemical science, those who have not considered the objects which it embraces will be enabled to judge of the importance of this study.

If we consider Chemistry purely as a science, we shall find no study better calculated to encourage the generous love of truth which confers dignity and superiority on those who successfully pursue it. There is no science which holds out more interesting subjects of research, and none which affords more striking proofs of the wisdom and beneficence of the Creator of the universe. A machine constructed by human art, is admired in proportion to the simplicity of its contrivance, to the extent of its usefulness, and to the niceness of its adaptations. But the works of man sink into nothing when brought into comparison with the works of nature. When we examine the former, every step of our progress is obscured with comparative clumsiness and defect: in contemplating the latter, we behold perfection rise on perfection, and more exquisite wonders still meeting our view. It is the merit of Chemistry, that by its aid we are enabled to take a minuter survey of the great system of the universe. And we find, so far as our limited powers can comprehend it, that the whole is nicely balanced and adjusted, and that all its changes tend to the most beneficial purposes. Circumstances which, on a superficial view, were seeming imperfections and defects, a closer inspection points out to be real excellencies. In all the singular and surprising changes which everywhere present themselves, the more closely we observe and examine them, the more we admire the simple means by which they are accomplished, and the intelligent design and perfect wisdom displayed in the beneficial ends to which they are directed.

Chemistry is a science that is founded entirely upon experiment; and no person can understand it unless he performs such experiments as verify its fundamental truths. The hearing of lectures, and the reading of books, will never benefit him who attends to nothing else: for Chemistry can only be studied to advantage practically. One experiment, well-conducted, and carefully observed by the student, from first to last, will afford more knowledge than the mere perusal of a whole volume. It may be added to this, that chemical operations are, in general, the most interesting that can possibly be devised.—*Griffin.*

## THE DAVY LAMP.

(*Concluded from page* 80.)

The circumstances which render this lamp an instrument of perfect safety may be thus stated: "Flame is gaseous matter heated so highly as to be luminous, and that to a degree of temperature beyond the white heat of metals or other solid bodies. When an attempt is made to pass flame through a very fine mesh of wire gauze, the gauze cools each portion of the elastic matter that passes through it, so as to reduce its temperature below that degree at which it is luminous; and the diminution of its temperature is proportional to the smallness of the mesh, and the mass of metallic wire." Moreover, the fine wire gauze is not only a conductor but a radiator of heat; consequently it possesses great cooling power; and when by this, or any other means, we cool a body of flame, the effect of cooling it will most certainly be to extinguish it. The wire gauze which encircles the lamp does not prevent the passage of the inflammable gas, but it prevents its emission in a state of inflammation; consequently nothing can pass from the interior of a lantern properly constructed, that is, at a temperature sufficiently high to inflame the explosive atmosphere of the mine. The temperature of a metallic body even when white-hot, is far below that of flame; therefore when the wire gauze of the lantern is red hot; it will abstract heat enough from the flame of the fire-damp to extinguish it before it passes through the meshes. So, if a wire gauze sieve be held over the flame of a common lamp, it will prevent the flame from passing it, al-

Digitized by Google

though the heated air which passes through will be hot enough to char a piece of paper held above the sieve; a phenomenon which is precisely similar to that exhibited by the wire gauze cylinder. A very simple experiment for the further illustration of the effect thus produced, has been suggested by Sir Humphry Davy. "Let" says he, "the smallest possible flame be made by a single thread of cotton immersed in oil: it will be found to be about one thirtieth of an inch in diameter. Let a fine iron made into a circle of one-tenth of an inch in diameter, and brought over the flame. Though at such a distance, if it be cold, it will instantly extinguish the flame, but if it be held above the flame, so as to be slightly heated, the flame may then be passed through it. That the effect depends entirely upon the power of the metal to abstract the heat of the flame, is shown by bringing a glass capillary ring of the same diameter and size over the flame: this being a much worse conductor of heat, will not extinguish it even when cold."

## GLASS STOPPERS.

### BEST MODE TO EXTRACT FROM BOTTLES.

*To the Editor of the Penny Mechanic.*

SIR,—Observing in the last Number of your Magazine (No. 10) a query to ascertain the "best mode of extracting glass stoppers," I beg leave to state, that the mode that has been tried with the greatest success is a very simple one—namely, to immerse the neck of the bottle in boiling hot water, and drawing it out immediately to give the stopper a sharp twist with the fingers. If the first trial should not prove efficient, the bottle should be wiped dry, and the experiment repeated. The reason of this is the momentary expansion of the neck of the bottle by heat.

I have, myself, tried many ways, but none ever succeeded so well as the foregoing, which you would oblige me by inserting.

The water should not be boiling, or it would most probably break the bottle. The water could be allowed to increase its temperature while the bottle was immersed.

HENRY MARTYN BAKER.

Another correspondent, C. D. T., recommends a similar plan; or that a cloth wetted with hot water should be wrapped round the neck of the bottle—the heat will cause it to expand, and the stopper can then be withdrawn, as it will not have been expanded by the heat of the water.

C. M. recommends placing the bottle in water, and letting the water boil, by which means if the bottle contains a liquid, sufficient steam will be generated to force the stopper out. If the bottle is empty the same effect will be produced by the air being expanded.

## INSTITUTIONS.

*The Mutual Instruction Society* meeting at the Southampton Coffee-House, Southampton-buildings, Chancery-lane, held a *Conversazione* on Thursday evening last. An excellent address on the occasion was delivered by the Chairman, after which several humourous recitations were given by Members, and the late Secretary was presented with "Combe's Physiology," handsomely bound, as a mark of respect of the members for the services rendered by him to the Society. Some very fine drawings by Mr. Foggo, and some by members of the society were exhibited. Also beautifully executed casts of the Lacoon; Venus de Medici; Rape of the Sabines; Mercury; Mary Magdalen, and other celebrated pieces of sculpture. There were also a variety of interesting specimens of the works of Nature and of Art exhibited. The entertainments of the evening appeared to give general satisfaction.

*The Finsbury Mutual Instruction Society.*—The Anniversary of this Society was celebrated on Monday evening last by a supper at the Strand Hotel. Several excellent speeches were delivered, and the company did not separate until an *early* hour.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday evening, Jan. 26, at seven o'clock, Dr. Ritchie, on Voltaic Electricity.—Thursday afternoon, Jan. 26, at one, Mr. Sheridan Knowles, on the Drama.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Jan. 25, at half-past eight, T. J. Searle, esq., on the Drama.—Friday, 27, Dr. Birkbeck, on Osteology.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Jan 26, at half-past eight, E. Cowper, on Calico Printing.

*Islington Literary and Scientific Society.*—Thursday, Jan. 26, at eight o'clock, Election of Officers.

## TO CORRESPONDENTS.

"D. Lewis." We shall perhaps be able to make use of the Sketch at some future time.

"W. C. C." is quite correct.

"M. Rough's," second letter has been received.

"S. T. C." next week.

The Books sent us to notice have also been received.

London: Printed at the Holloway Press, by D. A. Doudney: published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

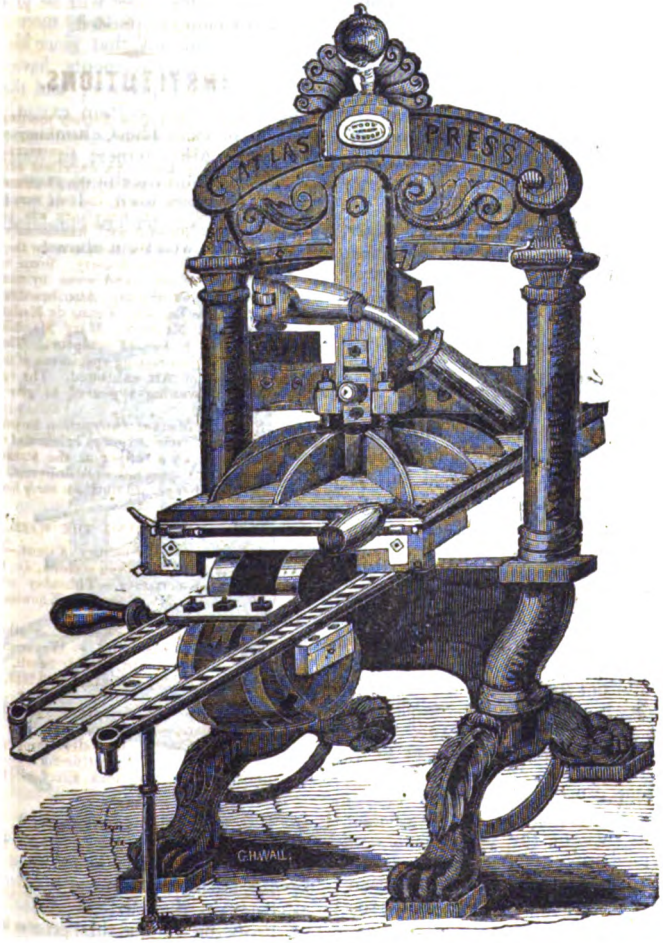
Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. XIII. & XIV.] JAN. 28, 1837. [PRICE 2*d*.

WOOD'S ATLAS PRESS.




VOL. I.—NOS. XIII. & XIV.

Holloway Press: D. A. Doudney.

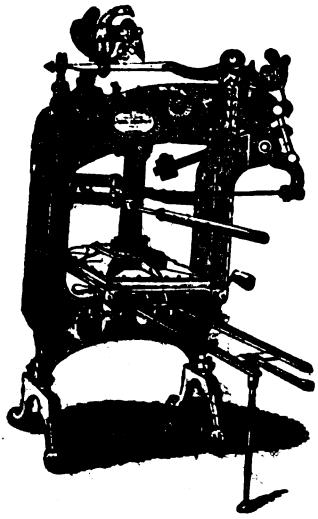
Digitized by Google

### WOOD'S IMPROVED PRINTING PRESS.

A short time since we had the pleasure of introducing to the notice of our readers a very ingenious invention of Mr. Hill's, for improving the printing machine. We have not less pleasure in directing attention to another kind of printing apparatus, a hand-press, constructed by Messrs. Wood and Sharwood, which for simplicity and power is superior to any with which we are acquainted.

In the present day, when in order to meet the increasing demand for knowledge, the various operations in printing are required to be executed with a rapidity, which to our forefathers would have appeared impossible, the steam engine has been called in to supply the place of animal power, and for newspapers and periodicals having a very extended circulation, a printing machine is absolutely necessary. But very considerable improvements yet remain to be effected in printing machinery, before hand-presses can be entirely dispensed with. Amongst the objections to machine-printing, is that of a want of uniformity in its execution; some sheets of paper may be printed with tolerable accuracy, as regards the quantity of ink, and its similar distribution throughout the pages, whilst others are likely to be thrown off the cylinder in a very disproportionate condition. Again, the commonest ink is used in printing by machinery, on account of its thin texture; the finer description of inks being of a stronger and thicker substance, the cylinder will not allow sufficient time for it to distribute itself equally over the roller, ere it had performed its revolution, and the type-form had returned to the rollers for its wonted supply of ink. The consequence is, the ink would appear in patches. On these, and many other accounts, hand-presses are invariably adopted where fine work is required; as experienced pressmen, by an attentive regard to the size and thickness of the type, substance of the paper, &c., can afford a moderate yet frequent and full supply, and thus insure the production of a volume beautifully clear and proportionate throughout.

Till about the commencement of the present century, the printing-presses employed were of a very inferior character, the only one in general use was that constructed by a Dutchman named Blaew, which though certainly a very great improvement upon the presses used before his time, was very objectionable on many grounds. In a future Number we will give an engraving of this press, when its construction and defects will be better understood than they can be by mere description. Lord Stanhope greatly improved this press, and made it altogether much better adapted to perform the work required of it. His press is still used by many printers, and would no doubt be more generally employed, but that since his time innumerable improvements have been made in printing-presses; and these of course have, to a certain extent, supplied its place. The Columbian press, invented by Mr. Clymer, an American, is a powerful and ingenious press, and is by many printers used. It is preferred by them for its ingenious combination of levers, as our wood-cut shows.

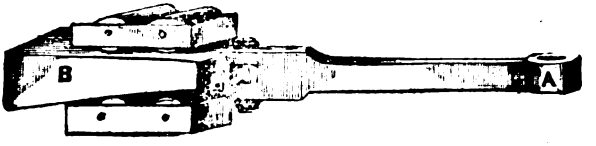


In this, as in all hand-presses, the object of the machinery is to bring a flat pressing surface, technically called the platten, upon the surface of the type. The means by which this process is accomplished has been invariably by the employment of one of the simple mechanical powers. In the early presses the

Digitized by Google

screw was adopted, afterwards, as we have seen, the lever was employed, in the one we are about to describe the wedge is made to produce the effect required.

The power of the wedge is well known, and it occurred to the inventor, that by introducing it into the machinery of the printing-press he should be able to employ a force, which, without occupying much room, would be capable of producing all the effects resulting from more complex machinery. This he has fully accomplished, and from the extensive patronage the press has already received from printers, it appears likely to supersede, to a great extent at least, the presses now in use.




The diagram shows the manner in which the wedge is applied, and will enable the reader to judge of the immense power to be obtained by the simple pulling of what is called the bar-handle from the right to the left-hand side of the press. And this purchase can be either increased or lessened by turning the screw exhibited in the front of the press. The following letter, which we have just received from our printer, affords, we think, satisfactory proof of the successful working of these presses.

"DEAR D——.

"You ask me my opinion of the *Atlas* printing press. I have had two in use for nearly six months, and am happy to inform you that I have found it as effective in its operation, and rapid in its movement, as it is simple in its construction. As far as my humble judgment extends, I think it one of the most successful pieces of mechanism ever presented to the public; it requires but little labour, is free from the liabilities to accident which most other presses are exposed to; occupies but small space, and, what is most desirable, produces an even and beautiful impression.

"Yours, truly,

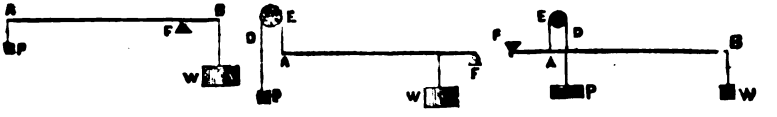
"D. A. DOUDNEY.

"Holloway Press, Jan. 1837."

---

## THE LEVER.

FIG. I. FIG. II. FIG. III.




THE *lever* is a *simple* mechanical power, it is called simple because it can be used without the aid of another machine. It is formed with a straight bar of wood or iron, resting upon some point as a prop or fulcrum, on which as a centre it turns. There are three kinds of levers, in the *first* and most common kind, the fulcrum is between the weight and the power; in the *second* the weight is between the fulcrum and power; and in the *third* the power is between the fulcrum and weight. Fig. 1. represents a lever of the *first* kind, the fulcrum or prop F being placed between the power P and the weight W; the power gained by the lever is in proportion as the arm A F, in length is greater than the arm F B, that is, if the arm A F be six feet long, and

Digitized by Google

the arm F B only one foot long, a power of one pound acting at A will balance a weight of six pounds acting at B, and if the arm A F be twelve times as long as the arm F B, the power gained will be as 12 to 1. This kind of lever is most commonly used to raise heavy weights, as large logs of wood, great stones, &c., to small distances, in order to pass chains or ropes under them, for the purpose of raising them to greater heights with more powerful machines; in this application of the lever, the extremity of its short-arm is put under the weight to be raised, a fulcrum is formed with a stone or block which is placed as near that end of the lever as possible, and the power or exertion used to move the weight is applied at the end of the long-arm of the lever. But in the practical use of this kind of lever, the short-arm F B should balance the long-arm A F, which may be done by increasing the thickness of the shorter arm. If the extremities of each arm of the lever were the same distance from the fulcrum, it would represent the beam of the common balance, with which different sorts of commodities are weighed, but the power gained being in proportion, as one arm of the lever is longer than the other, by this there would be no advantage received. The *steel-yard* is a lever of the first kind, which Fig. 1. may represent; the short-arm F B is, by an increased thickness, made to counterpoise the longer one A F, so that the lever when it is unloaded (except by the scale, which is suspended at the end of the short-arm) will hang in a horizontal position, now if a weight of one pound be hung on the long-arm as far from the fulcrum as the point B is, it will balance an equal weight in the scale suspended at B, but, if the weight be moved to 2, 4, 6, or eight times that distance from the fulcrum, it will be in equilebrio with a weight of 2, 4, 6, or 8 pounds in the scale, the distances from the fulcrum being respectively 2, 4, 6, or 8 times greater than B is. The poker when used for stirring the fire represents a lever of the first kind. The coals acting as the resistance or weight, the bar of the stove on which it turns the fulcrum, and the exertion at the handle the power; many common instruments continually under our notice, may also be referred to this kind of lever: as scissars, snuffers, pincers, &c.

A lever of the *second* kind, which has the weight between the fulcrum and power is represented by Fig. 2. The power gained by this kind of lever being calculated the same as in the former, it is evident that, if a weight W of six pounds hung one foot from the fulcrum F, and a power P of one pound hung at A, six feet from the fulcrum, by means of the cord D passing over the fixed pulley E, the advantage gained will be in the proportion of 6 to 1, or a power of one pound at P will balance a weight of six pounds at W. A pole supporting some heavy burden, carried between two men, represents a lever of this kind; and if the ability of one man, be greater than that of the other, by putting the weight as much nearer the stronger man than the weaker, as the strength of the former exceeds that of the latter, each may carry a weight in proportion to his strength; oars used to propel boats on the water are referable to this kind of lever, the water acting as the fulcrum, the boat to move the weight, and the boatman at the handle the power; to this lever may also be referred, doors which turn on hinges, cutting-knives which have one end fastened to a block, rudders and masts of ships, nut-crackers, &c.

The *third* kind of lever (Fig. 3.) has the power between the weight and fulcrum; therefore, the power being nearer to the fulcrum than the weight, it is clear that if a weight W of one pound act at B four feet from the fulcrum, it will require a power P of *four* pounds made to act at A, one foot from the fulcrum, by the cord D going over the fixed pulley E, to balance it. Therefore as no advantage is gained by this sort of lever, it is never used but in cases of necessity, as in placing a ladder against a wall, one end of it being fixed, while by the strength of the man raising it, it is put in an upright situation. The limbs of animals are constructed on the principle of this kind of lever; the arm for instance, the joint at the elbow is the fulcrum, the muscle the medium through which the

Digitized by Google

power acts, and the weight to be raised by the hand the resistance.

In conclusion, it must be remembered that the *space* passed through by the power, will be as much greater than that passed through by the weight, as the distance of the power from the fulcrum exceeds the distance of the weight from the fulcrum, so that, *strictly speaking*, there is no acquirement of power by means of the lever.

S. T. C.

## CURE FOR WASP STINGS.

*To the Editor of the Penny Mechanic.*

Sir,—Some time last Summer my mother was stung by a wasp; at the suggestion of my brother she applied carbonate of soda to the wound, and was immediately relieved from the agony produced by the sting.

A few days after a boy in my father's employ came crying into the shop, a bee having stung him on his eye-lid. It had commenced swelling; the carbonate of soda was again tried, and with the happiest results; he was immediately eased of the pain, and experienced not the slightest inconvenience from the sting afterwards.

Yours, &c., Thos. Engall.

## CHEMICAL RECREATIONS.

### ON MAKING EXPERIMENTS.

The chemical properties of a substance characterise equally the smallest portion of that substance, or the greatest mass. That which can be demonstrated of a pound, can also be demonstrated of a grain. Hence chemical experiments may be performed, either with large portions of matter, or with small portions; and whether in any case a large or small portion should be operated upon, is a thing to be determined solely by expediency. In trade, where productive experiments are made with a view to obtain preparations for sale, the quantities operated upon are often extremely large, amounting to many tons in weight. In analysis, the quantity of a body submitted to a test weighs sometimes but the fraction of a grain. When a lecturer has to teach chemistry to a large audience, it is his duty to make his demonstrative experiments upon rather a large scale, otherwise a majority of the persons present may not be able to perceive what takes place. And whenever a theory is built upon a single experiment, the lecturer should take particular care to make this experiment in such a manner that every person present may see and comprehend it fully; for if the demonstration is not made to *tell*, the theory sinks unheeded, and the arguments grounded upon it are fustian. I give this hint to the Members of Mechanics' Institutions, who have lately adopted the useful practice of lecturing to one another.

As the demonstrative experiments of the lecture-room are unavoidably scanty and unsatisfactory, the student who desires to know somewhat more of the science than he can learn there, must necessarily pursue his studies at home. I recommend him to be very cautious in believing the dogmas he hears and reads, without seeing the experiments which are intended to verify them. It is indispensably necessary, that he perform with his own hands the fundamental experiments of chemistry, in the best manner his time, his apparatus, and his means will admit of. He will find it of importance in this case to operate upon extremely small portions of matter; for he will then not only save time and money, but often be enabled to perform a successful experiment, where, by operating upon a large mass, he would as certainly fail. The preparation of the gases, the formation and crystallisation of salts, the application of tests, and a thousand other entertaining and instructive experiments, can all be performed by the student, better on a small scale than in the large way; nay more, a student in his closet very frequently succeeds in performing an experiment which fails on the lecture table of the professor; for the accidents which attend the hurry and business of a lecture-room produce unavoidable disappointment. This therefore is a circumstance of which the chemical student should be prepared to take every advantage. The faculty of experimenting with accuracy, facility, and economy, ought to be gained as

Digitized by Google

speedily as possible; for it is upon that faculty that the progress of the young chemist is principally dependent.—*Griffin.*

### THE MINER'S FUND SOCIETY.

A Society is about being established for the purpose of assisting the widows and families of miners who may be killed by sudden explosions or other accidents in mines. The plan on which the society is to be formed, is not yet definitely determined on, but the necessity for some association of the kind must be evident to every one who considers the many accidents to which miners are liable, and the few opportunities they have for providing against a time of sickness, or for protecting their families from want in case of death. The editor of the *Mining Gazette* in his paper of last Saturday, eloquently remarks upon the subject. "No accidents are so frightful as those to which the miner is subject—no foresight can calculate on their occurrence—no forethought can provide against them. Unseen, unheard, almost without intimation, in a moment of jocular hilarity, or diligent exertion, the feel monster swoops, in an instant, upon his prey—without even a chance of escape his victims are overwhelmed, until their mangled and appalling forms present the dreadful evidence of his fury. The bereft widow is left to mourn, in chill distress, through a long life of lonely sorrow, while her fatherless orphans, half unconscious of their loss, until opening intellect enables them to perceive the hardship of their fate, are brought up to endure the same toil, and perhaps abide the same lot as hurried their unfortunate parent into eternity." While we cannot forbear remarking that many, and very many, of the working classes are exposed to dangers, nearly, if not quite as great as those of miners, and are equally deserving to be provided for in cases of distress and sickness, at the same time, we would earnestly impress upon all who have the means of assisting the Society about to be formed, that they cannot bestow their money in a manner more benevolent and with greater probability of its producing a beneficial effect.

### EXTRAORDINARY EXPERIMENT.

*(From the Somerset County Gazette.)*

We feel much pleasure in communicating to our readers the following singular experiment of our now celebrated neighbour, Mr. Andrew Crosse. The public are aware that Mr. Crosse has been recently pursuing a series of researches into the process of crystallization by means of his galvanic batteries, and that he has made discoveries which have thrown quite a new light upon science. Some weeks ago he prepared a silicious fluid for the purpose of crystallization. He heated a flint to a white heat, and then plunged it in water to pulverize it. The silex, thus reduced, was saturated to excess with muriatic acid. The mixture was placed in a jar—a piece of flannel was suspended in it, one end of which extended over the side, and thus, by capillary attraction, the liquor was slowly filtered, fell into a funnel, and thence dropped on a piece of iron-stone from Mount Vesuvius, upon which were laid the two wires connected with either pole of the battery.—We should state that the iron-stone had been previously heated to a white heat, so that no germs of life could have existed upon it. Mr. Crosse made his daily observations of the wires to discover the beginning of the process of crystallization. On the 14th day he saw some small white specks upon the stone. Four days afterwards they had elongated, and assumed an oval form. He concluded that they were incipient crystals. Great was his surprise on the 22d day to find eight legs projecting from each of these white bodies; still he could not believe that they were living beings. But on the 26th day his surprise was complete; there could be no doubt they moved, they fed, they were perfect insects,—18 or 20 of them have since appeared. Many persons have seen them, but there is no record of such an insect. It is in form something like a mite. It has eight legs, four bristles at the tail, and the edges of the body are very bristly. Its motions are visible to the naked eye—its colour is gray—its substance is pulpy. It appears to feed upon the *silicious* particles in the fluid. The most extraordinary circumstance in this phenomenon is the nature of the fluid in

Digitized by Google

which this insect lives and thrives. The acid instantly destroys every other living being. But a second trial has confirmed the fact beyond a doubt. Another portion of silex was prepared in the same manner, and reduced to a gelatinous form, but without the acid. A coil of silver wire was suspended in it from one of the poles of the battery, and the other pole was also immersed, so as to send through the mass an incessant stream of the electric fluid. About three weeks afterwards Mr. Crosse examined the poles to search for crystals, and in one of the coils of wire he found one of these strange insects. This proves that it is produced from the silex, and not from the acid. Mr. Crosse, with his usual modesty, has contented himself with stating the fact, without attempting to account for it. He is in correspondence with Professor Buckland upon the subject, and the learned professor has suggested an explanation, which it will be for future observers, by repeated experiments, to confirm. We should state, that the insects were principally found at the negative pole of the battery. A German naturalist has recently discovered that silicious and other rocks are chiefly composed of the remains of insects. May not the germs of some of them, released from their prison-house, and placed in a position favourable to the development of vitality, have sprung to life after a sleep of thousands of years?

[The above account has been going the round of the newspapers during the last fortnight, but we are inclined to think the story will turn out very similar in many respects to that of the "three black crows." The last paragraph is enough to make us incredulous; besides, the account contains statements of a very doubtful character. We should like to know *why* "the iron stone had been previously heated to a white heat?" We should also very much like to see a flint stone "reduced to a *gelatinous* form," either with or without acid! The experiment would no doubt be highly gratifying to chemists. Mr. Crosse does not appear to have communicated his wonderful discovery to any of the philosophical journals of the day, and as it has merely appeared in the newspapers, at a time when many murders and dreadful accidents are *manufactured* to supply the deficiency of the parliamentary debates, we are inclined to think the statement all —fudge!] ED.

## CHEMICAL RECREATIONS.

### EXAMPLES OF AFFINITY.

TAKE a little common magnesia, and pour by degrees diluted nitrous acid upon it till the whole of the earth be dissolved. This is an instance of simple chemical affinity. But if a solution of potash be poured upon the former mixture, the potash having a greater affinity for the acid will take it from the magnesia, and the magnesia will again be precipitated.

To a solution of soap add a little weak sulphuric acid. The acid having a stronger affinity for the alkali of the soap than the alkali has for the tallow, the acid will unite with the alkali, and the separated tallow will be seen to float upon the surface of the liquor.

Dissolve a few ounces of sulphate of iron in water, by adding the salt by degrees till the liquor becomes turbid; then, if a skain of cotton thread be dipped in the solution and shaken a little in it, the thread will take up the whole of the oxide of iron, and render the liquor transparent. The effect is produced in consequence of the great affinity which cotton has for the oxides of iron.

If mercury be put into a *glass* bottle, the surface of the mercury will appear convex, owing to the small affinity which mercury has with glass; but if it be put into a *metallic* vessel, the surface of the mercury will appear concave like that of other fluids, because of its tendency to combine with the sides of the vessel. This may be adduced as a striking proof of metallic elective attraction.

The phenomena of dyeing may also be referred entirely to chemical principles. The colouring particles possess chemical properties that distinguish them from all other substances; they have attractions peculiar to themselves, by means of which they unite with acids, alkalies, metallic oxides, and earths. The difference in the attractions of the colouring particles for wool, silk, and cotton, is sometimes so great that they will not unite with one of these substances, while they combine very readily with another;

Digitized by Google

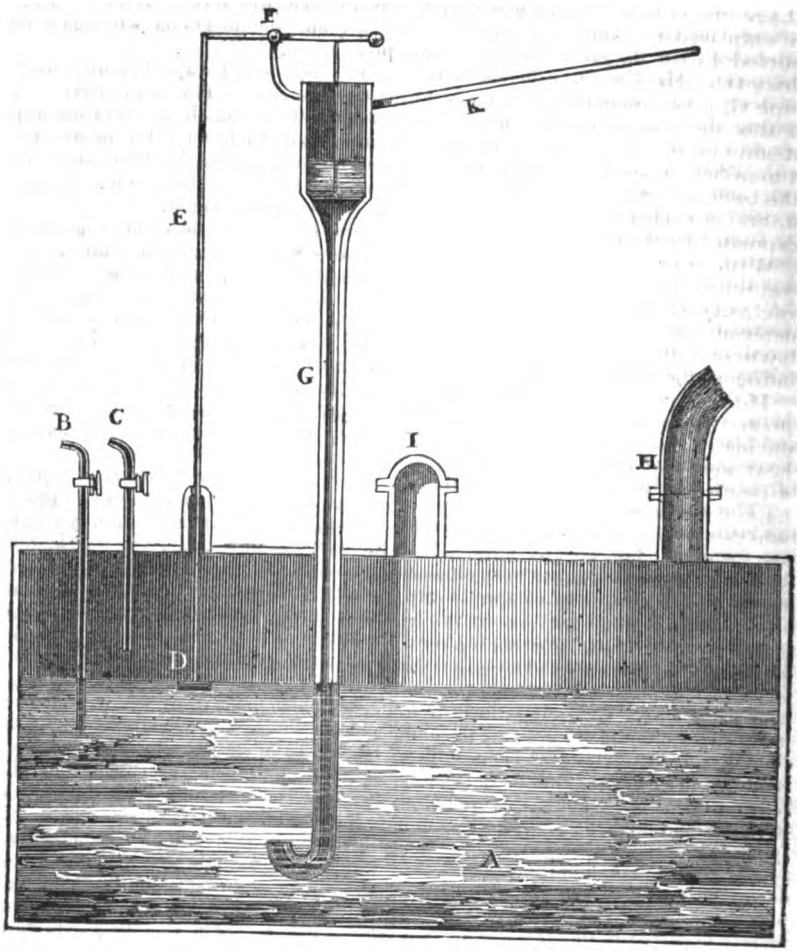
thus *cotton* receives no colour in a bath which dyes *wool* scarlet.

Chemical affinity may be pleasingly illustrated by the composition and decomposition of writing ink. Take a little tincture of galls, and a little of the solution of green copperas, both colourless liquors, and, if poured together, the mixture becomes black; from the affinity which gallic acid has for the oxide of iron in the copperas. Then pour in a little weak aquafortis, and the liquor will become immediately transparent: this arises from the metal leaving the first acid to unite with the last, to which it has a greater affinity. But if a solution of potash be now added, the nitrous acid will quit the iron, and unite with the alkali: thus the iron, being once more disengaged, will again be caught by the gallic acid in the infusion, and once more produce a black liquor.

PARKES.

---

MODE OF FILLING BOILERS.




THE above engraving representing a boiler in which steam is generated, is of too much importance to pass unnoticed. A represents the interior of the

Digitized by Google

steam boiler. D is a stone float suspended by the wire E to one arm of a lever F, and is so counterpoised by the opposite extremity of the lever, that it always remains at the surface of the water in the boiler; its specific gravity, which would otherwise cause it to sink in the water, being diminished by its connection with the lever. B and C are two pipes communicating with the interior of the boiler, the lower extremity of the former being immersed in the water, and that of the latter terminating at some distance above its surface. The small pipe K is employed to supply the water admitted by the operation of the stone float D, and which, descending by the pipe G, is seen to enter the boiler. H is the steam pipe, through which the steam passes into the cylinder, and I is a man-hole, to enable a person to enter the boiler for the purpose of cleaning it, and removing the stony concretions deposited by the water.

With reference to the quantity of water in a boiler, the principal question, exclusive of the saving of heat, is to determine how far the depth or shallowness of the water in the boiler may influence the production of steam.

If the parts of a mass of water could preserve the same relative positions during the application of heat, and this heat were applied at the bottom under a depth of six feet, it would depend upon the conducting power of the fluid whether the upper or lower parts should give off the greatest quantity of steam in a given time. If the lower parts were to afford the greatest product, this would be done under a greater pressure and at a higher temperature; so that it would become an object of experimental research, whether such steam, by giving out heat to the superincumbent water through which it must rise, and rendering a portion of it elastic, might not be as effectual in its ultimate operations, as if the heat had been employed upon a shallower mass.

## ON LIGHT.

The nature of light has ever been a subject of controversy. It was Newton's explanation that luminous objects give out particles of inconceivable minuteness, and moving with extreme velocity. "What mere assertion," says Sir John Herschel, "will make any man believe that, in one second of time, in one beat of the pendulum of the clock, a ray of light travels over 192,000 miles; and would therefore perform the tour of the world in less time than a swift runner would make one stride?" In short, there is nothing like it but the influence of attraction; which is so instantaneous as to admit of no calculation of time at all. A different theory from that of Newton was suggested by Huyghens, who supposed a highly-elastic fluid to fill all space, and which, when moved, produced the effects ascribed to light. Instead of minute particles diverging from the luminous body, he substituted waves or vibrations, propagated through this elastic ether. The late Dr. Young, and some continental philosophers more recently, took up this hypothesis and supported it by ingenious experiments. But notwithstanding that it is the favourite theory of the day, difficulties appear still to encumber it. The theory of undulations implies the advance and recoil of the elastic medium, and that gives the idea of retardation. The supposition of light being the effect of the motion of an ether, does not fall in with our conceptions of the manner in which it enters into the composition of bodies, or influences chemical combinations, or affects the living power of animals and vegetables. The merits of the two theories, however, need not be discussed here. It will be sufficient for our purpose to enter on the explanation of a few of the laws which influence a ray of light in passing through transparent media.

When the ray of light passes perpendicularly from a rarer into a denser medium, as from air into water, it suffers no change in its direction; but when it passes obliquely, it takes a new direction towards the perpendicular, making a sudden angle, as if broken,—and this is refraction. Two circumstances, therefore, influence the ray of light;—the angle at which it falls, and the density of the body into which it passes. When the ray passes from the denser medium into the rarer, it is again refracted, but away from the perpendicular, and takes

Digitized by Google

its original course, provided the surface at which it goes out is parallel to the surface at which it entered. When a ray strikes upon a body that is not transparent, or only imperfectly so, it is in part reflected, that is, struck off again, bent back, or reflected, and enters the eye, conveying to us the impression of the form and colour of that object. But the expression which we have used requires explanation; for how is it that the reflected rays should convey the idea of colour? The prism is a piece of glass so formed that the rays must fall obliquely on one or both of the surfaces, and suffer refraction. Thus a ray striking into the prism is refracted; but all its parts are not equally refracted, and as the light consists of parts differing in colours, and which are differently refracted, it is divided or dissected into several colours, called the prismatic colours. The spectrum, as it is termed, thus formed, consists of seven colours; that which is least refracted being red, and in succession orange, yellow, green, blue, indigo, and violet. If these rays be re-compounded by passing through a convex lens, which, owing to the obliquity with which they fall, draws them to a point, the focus of the light will be again colourless. Some modern philosophers have reduced these prismatic colours of Newton to three primary colours, red, yellow, and blue; contriving, by the super-position of these, to produce the seven tints; while others have, on considerations not easy to be disproved, held that there is not any definite number of colours, but a gradation of tints from the extreme red to the extreme violet. We may now understand the reason of the colour of objects. When light strikes upon a body, even upon the most transparent, part penetrates, part is reflected, and some part is lost. A dye is a disposition given to the surface of cloth to repel some of the rays of light more than the others; and the colour will be according to the ray, or the combination of rays, thus cast back and sent into the eye.

And here it is natural to reflect on the variety and beauty everywhere bestowed through this property of the beam of light. What a dulness would have pervaded the surface of the earth if there had been only a white light! The beauties of the garden and of the landscape would have been lost to us. How is the beauty of the latter enhanced by the almost infinite variety of colour, yet still within that range which is agreeable and soothing to the eye, as well as consonant to our feelings! The human countenance, too, although capable of exciting our warmest sympathies by form and motion alone, has that beauty perfected by colour, varying under the influence of emotion.

It remains, in order that we may apply these facts to the explanation of the structure of the eye, to show how the rays proceeding from a body and falling upon a convex glass suffer refraction. The ray that strikes upon the centre, being perpendicular to the glass, passes on undeviatingly. But each ray as it strikes a point removed from the centre, must impinge with more obliquity, in consequence of the curved surface; and as the refraction of all the rays will be in proportion to the obliquity of their incidence, they will converge towards the central direct ray.

### THE EYE COMPARED WITH OPTICAL INSTRUMENTS.

It is surprising that the structure of an animal body should so seldom be taken as a model. In the history of inventions, it appears quite extraordinary that the telescope and the microscope should be modern, when, as it should seem, the fine transparent convexity of the eye might have given rise to imitation, as soon as man learned to give shape to natural or artificial glass. It reminds us of the observation of Locke, in speaking of a discovery, that it proved the world to be of no great antiquity. Yet we must estimate the invention of the telescope and microscope as by far the most important in their consequences of either ancient or modern discoveries. The first opens to us an unlimited expanse, not only of new worlds, but systems of worlds, and new laws evinced in the forces which propel and attract these; since in the heavenly bodies we find no material contact, nor pressure, nor impulse, nor transfer of power—nor effect of heat, nor expansion of gases—nothing, in short, which can be illustrated by mechanism. By the microscope, we contemplate the minute struc-

Digitized by Google

ture of animals and things but for its aid invisible: the balance of the cohesive and repulsive forces as they order the changes in the material of the world, and in that of our own frames. Yet these instruments are not in contrast with the eye: but through the comparison of them we discover the wonderful adaptations of that organ; of which it has long ago been said, that it can at one time extend our contemplations to the heavenly bodies and their revolutions, and at another limit its exercise to things at hand, to the sympathies and affections of our nature visible in the countenance. If we put aside the consideration of the living properties of the organ, as the extraordinary variety and degrees of sensibility in the nerve of vision, and confine ourselves to points easily comprehended, as, for example, the mechanism of the eye, and the laws of optics as applicable to the humours, we shall find enough to admire. When we look upon the optician's lens, however perfect its polish may be, we can see its convex surface: that is to say, the rays of light which strike upon that surface do not all penetrate it, but are in part reflected to our eye, which is the occasion of our seeing it. We do not see the surface of the cornea of the human eye. Here, then, is an obvious superiority, since it implies that all the rays of light which strike the cornea enter it and are retracted, and none are returned to our eye. If we take the optician's lens between our fingers and hold it under water, we can no longer see it, however transparent the water. The reason of this is, that the rays of light are reflected when entering from a rare medium into a denser, more abundantly in proportion to the difference of the density. When the ray of light has penetrated the water, it also penetrates the glass, because there is not that difference of density between the water and the glass which there is between the atmosphere and the glass. From this we may estimate the importance of the surface of the cornea being moistened by the tears; for however thinly the water may be spread over the surface of the eye, it is sufficient to make those rays that would otherwise be reflected penetrate the cornea. The whole humours of the eye are constituted with a regard to this law. There is nowhere an abrupt transition from a rare to a dense humour. The ray is transmitted from the cornea into the aqueous humour, and through that humour into the lens or crystalline humour. Were this latter humour uniform and of the density of its central part throughout, the ray would be in part reflected back from its surface. But it is not uniform, like a mass of glass: it consists of concentric layers increasing in density from the surface to the centre. If we first look at the entire lens, and then take off its concentric layers, we shall see the surface of the internal nucleus more distinctly than the exterior and natural surface. The reason is obvious: the nucleus is so much more dense than the atmosphere, that the reflection of the rays from it is more abundant. We now comprehend how finely it is provided that the crystalline lens should be surrounded with the *liquor Morgagni*, a fluid which is but in a slight degree more dense than the aqueous humour. The exterior surface of the lens itself is only a little more dense than the surrounding fluid, and each successive layer, from the surface to the centre, is of gradually increasing density: so that if we were to describe the course of the ray, it would not, as we see in the ordinary diagrams, pass like a straight line of the pen, but in a curved line, showing the gradual manner in which the ray is refracted through successive transparent layers. As it enters in the anterior half of its passage, it encounters media of increasing density: but as it passes out behind, it is transmitted through media diminishing in density. The ray is nowhere opposed by that sudden increase of density which gives a disposition to reflection; and it passes through the vitreous humour still refracted, the density of that humour having a just correspondence with the posterior surface of the lens. In the atmosphere there is a similar arrangement for receiving the light proceeding from the sun or stars: for as the density of the air diminishes as the height above the earth increases, the surface of our atmosphere, from its rarity, must almost resemble free space; consequently the light falling into it will penetrate more abundantly than if the air were compressed as it is near the earth, and were of uniform density. We

Digitized by Google

thus see the obvious superiority in the structure of the eye to any thing that can be composed of glass, which is of uniform density throughout, and must therefore present a succession of surfaces where rare and dense media are abruptly opposed to the rays transmitted. We may observe another happy result from the peculiar structure of the lens. A magnifying glass is never true: an aberration of the rays takes place in the pencil of light, as the rays are drawn to a focus. The rays which penetrate near the centre are projected so as to be drawn to their focus beyond those rays which pierce through nearer the edge. The rays penetrating the centre of this double convex glass will project the image to a greater distance than those penetrating nearer the circumference, and consequently falling more obliquely, will form a focus nearer the lens. But in the crystalline humour of the eye, which corresponds with the optician's lens, the exterior layer having less density, and therefore a diminished property of refracting the ray, the image is carried farther off; and by this means it is ordered that wherever the ray penetrates, it shall be drawn to an accurate focus. Some modern philosophers have asserted that the eye is not perfectly achromatic in every adjustment. The term implies the property of the instrument to represent an image divested of the prismatic colours; those false colours which attend the refraction of the rays of light. If the statement be correct, it is nothing against our argument; nor have those inquiries advanced it with any such view. We know that in all the ordinary exercises of the eye the image is perfect, having neither penumbra nor prismatic colours. This property of the eye results from the different media through which the rays are transmitted, and the gradual transmission which we have just mentioned. Dollond's achromatic glasses, a great improvement upon the telescope, were made on this principle. He composed the object-glass of the telescope of crown-glass and flint-glass, so that while, by the combined effect of their convexities, they drew the rays to a focus, the dispersive power of the one was counteracted by that of the other. Let us endeavour to explain this. A beam of light, being composed of the different coloured rays, passes through a prism. Instead of passing onward in a straight line, it is refracted in distinct, and, consequently, coloured rays. Whilst the whole of them are bent or refracted at an angle, they are also diverging from one another. Their deviation from the straight line is their *refraction*: their diverging from each other is their *dispersion*. These properties being distinct, it is conceivable that glass of a different chemical composition may affect the one to a greater degree than the other, and, therefore, that a lens may be composed of different kinds of glass (crown-glass and flint-glass, for example), so that the convergence of the rays into a focus may be obtained without the dispersion of the rays, and the consequent production of false colours round the image. This is what Dollond nearly accomplished, and upon these principles. That the effect of this very artificial arrangement is attained in the eye is a remarkable proof of the perfection of its adaptation to the properties of light. The last circumstance which we may mention in continuing the comparison, is the drawing out of the tube in the telescope to accommodate the foci of the glasses to the distance of the object. It is sufficient to say that the eye possesses this property of accommodation. That we do not understand how the operation is performed, only strengthens the argument in favour of the perfection of the eye: since the power exists, and is exercised with an ease which hardly permits us to be sensible of it.

Sir C. Bell.

---

Write upon paper with a diluted solution of muriate of copper; when dry it will not be visible, but on being warmed before the fire the writing will become of a beautiful yellow.

---

*To the Editor of the Penny Mechanic.*

CONSTRUCTION OF RAILWAYS.

Sir,—Mr. Vignoles, civil-engineer, has published, in the form of a report to the directors of the Midland Counties Railway Company, a plan for making the Upper Works of Railways; by adopting which, he proposes to save, in two trackways, from £800 to £2,200 per mile. He might have said much more; and I

Digitized by Google

fully concur in opinion with him, that "a more economical and better mode of construction might have been adopted by the Directors of the London and Birmingham, and other principal Railways now in the course of construction," than that to which, despite the report of Professor Barlow, and the other warnings they have had, they seem, by some fatality, resolved to adhere; in which opinion, I unhesitatingly assert, the shareholders in the London and Birmingham Railway will also concur, when, at no great distance, they will be informed that the directors must have fresh powers, either to issue an additional number of shares, or to borrow additional sums on mortgage, either being to the manifest detriment of the original shareholders, over whom the money lenders, in whatever form they may present themselves, will have a decided advantage. It is now too late for the shareholders of the London and Birmingham Railway Company, and those of the other Railway Companies alluded to by Mr. Vignoles, to profit by his judicious, though sarcastic reflections; but other companies may take the hint, and avoid the rock on which their inexperienced, if not obstinate, predecessors have split.

Mr. Vignoles, however, understands theories somewhat better than making calculations and estimates; for he writes down the cost of a stone sleeper, of five cubic feet, (which weighs from 6 to 7 cwt.) 4*s*.; whereas the lowest price at which granite, or other equally hard and suitable blocks, can be procured at any quarry, is about 1*s*. per foot; and, whereas the cost of transport from the quarry to any spot on the London and Birmingham line, cannot, upon the average, be less than 20*s*. per ton, which is 6*s*. 6*d*. per block. I know that 7*s*. 6*d*. each is asked for Yorkshire blocks, (not granite) in the River Thames; to which price are to be added lighterage, unloading into canal boats, canal conveyance to the spot nearest to the railway; landing, loading, and cartage to the railway, and hauling along it (perhaps some miles,) to the place where the blocks are to be laid down.

Mr. Vignoles' plan is to use fir planks, 9 inches wide, and 4½ thick, bedded on ballasting, which is loose gravel, as a continuous support of his frame work, on which are mounted rails, at the top resembling the rails at present in use, though their base is 5 inches, and they weigh 48 lbs. per yard.

Now, as this gentleman advocates the continuous support of the rails, and represents wood, even fir, to be a much better bearer for rails than stone blocks, it is singular that he should not have called the directors of the company in question to my plan, of which these two objects form so prominent a feature. Of its superiority over the existing mode of construction, we have (at least in reference to these objects) a decided confirmation, as Mr. Vignoles, in respect to theory, is held to be an authority.

Mr. Vignoles intends to hold together the two logitudinal bearers for each track-way by wooden girders, at a short distance apart, so that the whole will form a frame, something like a huge ladder; and to secure the rails to the frame-work by nails or spikes; and if wrought iron rails are used, each track-way, (that is two rails for a carriage to run on,) will, according to his estimate, cost 22*s*. per yard, or 11*s*. for a single line of rail.

Whether loose stones will constitute a continuous, solid foundation, especially on clay and other soft earth; and whether, any dependence can pe placed on the stability of the frame work, that is, its continuing an absolute fixture, considering the nature of the trial to which it will be subjected, I must leave the public to judge, entertaining the opinion, that a decided preference will be given to bearers buried in and consolidated with a bed of concrete; two feet or more wide and deep, and which, for solidity, strength, and durability, will resemble a continuous rock throughout the line.

Then, the species of wood to be employed for bearers. Mr. Vignoles is for fir, which after being kyanized, he supposes will last seven years; but I am for oak, which after undergoing the same process, will last seven times seven years; and during this period no interruption be occasioned to the traffic, by taking up old bearers and putting down new ones. Again, Mr. Vignoles will secure, (that is, if wet, dry, and hot weather permit,) the rails to fir bearers by nails; but screws in oak bearers render my plan independent of the influence of the weather.

Digitized by Google

Now, as to price: Mr. Vignoles' plan costs 11*s.* per yard; but I have made known that the maximum price of mine will be 10*s.*, though in many, perhaps in most parts of the country, the price will not exceed 8*s.* per yard, even if it does 7*s.*; and were Memel fir to be used instead of oak, and nails instead of screws, a further diminution of 1*s.* per yard, might be made. But who that reflects, would thus economize? Mr. Vignoles' iron rail costs 5*s.* 7*d.* per yard, but mine only 1*s.*; and where he uses four feet of fir, I use only one of oak. He has no means for the bars to expand and contract, but upon my plan this advantage is enjoyed.

In conclusion, I thank Mr. Vignoles for his publication, which, on account of its theoretical data, I deem of great value.

THOMAS PARKIN.

Patent Railway Office,
31, Broad Street Buildings,
16th Jan. 1837.

## THE PROPERTIES OF MATTER.

THE term "matter" has been defined to mean "every thing that has length, breadth, and thickness, and resists the touch;" or it may be said to be "every thing of the existence of which we are informed by our senses." Before a person can understand even the principles of natural philosophy, it is necessary that he should become acquainted with the properties of matter, as on these all his speculations must rest. Matter is of two kinds, organized or unorganized, that is to say, it is either living or dead; both kinds obey the same laws to a certain extent, the former however has properties that are not possessed by the latter.

All material bodies may exist in three different states; as a solid, a fluid, and as a gas or vapour. These changes are entirely dependent on the agency of heat. To illustrate this, let us observe the changes that are produced on water by heat. Water deprived of a portion of its latent heat, becomes ice; this exposed to heat again changes to water, and, by an increase of temperature, it can be formed into steam. Other bodies are acted upon in a similar manner by heat. It causes a repulsion amongst the minute particles that constitute what we term matter, by which means the body they form becomes enlarged, and is specifically lighter. To the agency of heat, then, we are indebted for the various forms under which matter exists, and the various changes that take place in it. Leaving till another period the consideration of the laws which regulate heat, we shall proceed to describe the properties belonging to matter in whatever form it may exist. These are *solidity*, or, as it has sometimes been termed, impenetrability; *inertia; divisibility; attraction;* and *mobility.*

*Solidity.* An ingenious metaphysical theory was propounded some years ago by Bishop Berkeley, which endeavoured to prove that matter did not exist; that as colour was only a sensation, and did not really belong to a body, so our idea of the existence of matter was in like manner only imaginary. Of this theory it has been remarked, that if a man were to run against a post, he would feel something more than an imaginary blow! This arises from matter being impenetrable, and is perhaps the best answer that can be given to the theory. We cannot force one substance into the place occupied by another without displacing the latter, because its solidity will prevent such an occurrence. There are some apparent exceptions to this law. For instance, we can mix a quantity of salt with water, without increasing the bulk of the water; this, however, is not in consequence of the salt forcing itself into the particles of matter which form the water, but because it occupies the minute spaces between the particles of water, that previously existed. The atmosphere, although invisible, is yet a material body, and possesses the property we are describing. If we invert a wine glass in a bason of water, and press the glass down to the bottom of the bason, we shall find that the water will not rise in it above a certain height; this is because the air within it is impenetrable, and must be displaced before the water can occupy its place. If matter did not possess impenetrability, "the great globe itself, and all which it inherits," and not these alone, but the whole solar system, and every star in the firmament, however great their

Digitized by Google

magnitude, might be compressed into the point of a pin! but as every atom, however minute, occupies a certain space, beyond which it cannot be compressed, the very idea is absurd. The change of volume that steam undergoes in being converted into water, is not owing to the particles which compose it being compressed, but merely to their being allowed to approach nearer to each other, in consequence of a reduction of temperature.

The next property of matter is *inertia*, or that by which it endeavours to continue in whatsoever state it may be in, whether of motion or of rest. Neither of these qualities are peculiar to matter, although by some it might be imagined to have a natural tendency to remain at rest. We know a cannon ball could never put itself in motion, and we know it will come to a state of rest, yet the latter is not produced by the ball itself any more than the former; it results from friction and from gravity: from friction it may be of the atmosphere only, but still this is the cause of its loss of motion. Could we project a body into space, where it would not have to overcome friction, it would continue in motion for ever. We have examples of this in the heavenly bodies; the moon revolves round the earth, and the earth round the sun, without the slightest intermission, because they are not opposed by friction. An illustration of the inertia of matter may be seen in the difficulty with which a carriage or waggon is first put in motion; and, after it has been going some time, it is equally difficult for the horses to stop it suddenly. In both cases matter has a tendency to continue in the state it was—in the former, at rest; in the latter, in motion. When a coach first starts off, the passengers sitting with their faces to the horses fall backwards; those sitting with their backs to the horses, fall forwards. A man standing up in a boat, when it first puts off from the landing-place, will in like manner fall backwards, unless he is careful. If we place a card on the top of the finger, and put a halfpenny above it, over the point where the finger touches the card, we may, by giving the card a smart blow on the edge, make it fly off, leaving the halfpenny behind, because of its inertia. The reverse of this experiment may sometimes be seen to take place with an unskilful horseman. If the horse, while trotting rather quickly, be stopped suddenly, the rider will be thrown over its head, because the inertia of his body will not allow him to come to a state of rest at the same time with the animal he is riding.

We shall continue this subject, and describe the other properties of matter in a future paper.

### THE STEAM GUN.

The steam gun is formed simply by introducing a barrel into the steam generator of any engine, and by the addition of two pipes towards the chamber of the gun, which by the action of a handle to the chamber are dropped into the barrel, and fired one by one, at the rate of several hundred in a minute. When a force of 840 lbs. to the square inch is applied, a musket ball, fired at an iron plate 100 feet distance from the gun, is actually driven to pieces in such a way, that none of its fragments can be collected. These guns are said to be more safe than the common guns. Ten cannons upon this principle, it is stated, would in a field of battle be more than equal to 200 on the present system; and a vessel of only 6 guns would be rendered more than a match for a 74: of 500 balls fired every minute from one of these guns, if only one out of 20 were to reach the mark, ten of such guns would destroy 150,000 men daily. By many the perfection of the invention is hailed as a benefaction, which will put a stop to wars and to tyranny; for say they, as a few of these guns would sweep away whole armies from the face of the earth, where could the supplies of men be found, and what tyrant could oppress a people who were possessed of them.

We purpose giving an engraving of this next week.

---

*The Liverpool and Manchester Railway* was measured last week by order of the directors, and was ascertained to be 30¾ miles and 33 yards long.

Digitized by Google

## MANUFACTURE OF SHOT.

THE manufacture of small shot is a curious process. In melting the lead, a small quantity of arsenic is added, which disposes it to run into spherical drops. When melted, it is poured into a cylinder whose circumference is pierced with holes. The lead streaming through the holes, soon divides into drops which fall into water, where they congeal. They are not all spherical; therefore, those that are must be separated, which is done by an ingenious contrivance. The whole is sifted on the upper end of a long smooth inclined plane, and the grains roll down to the lower end. But the pear-like shape of the bad grains makes them roll down irregularly, and they waddle as it were to a side; while the round ones run straight down, and are afterwards sorted into sizes by sieves. The manufacturers of the patent shot have fixed their furnace, for melting the metal, at the top of a tower 100 feet high, and procure a much greater number of spherical grains, by letting the melted lead fall into water from this height, as the shot is gradually cooled before it reaches the water.

---

*Safety from speed in Skating.*—A person may skate with great rapidity over ice which would not support his weight if he moved over it more slowly. This arises from the fact, that time is requisite for producing the fracture of the ice: as soon as the weight of the skater begins to act on any point, the ice, supported by the water, bends slowly under him; but if the skater's velocity is considerable, he has passed off from the spot which was loaded before the bending has reached the point which would cause the ice to break.

---

If hot water be poured into a glass jar of cold water, it will remain on the *surface;* but if cold water be poured upon hot water, it will sink to the *bottom* of the vessel. This experiment may be rendered more obvious by colouring that portion of the water which is poured in. The design of this experiment is to show the change of the specific gravity of the *same* body, merely by the agency of caloric.

## INSTITUTIONS.

*At the London Mechanic's Institution*, after the lecture by Mr. Haydon on the Fine Arts, on the 20th instant, it was announced that a Drawing class would be formed under the superintendence of a gentleman of talent, and a preliminary meeting was called for the 23rd instant. The meeting was held accordingly, when it was determined to request Mr. Haydon to superintend the class, which it was understood he would do on receiving a very slight remuneration for his services. The members who then intimated their willingness to form the class, arranged that the subscription should be *Five Shillings* per Quarter, which, if the class consisted of Fifty members, it was expected would be sufficient to cover all expences.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday evening, Jan. 30, at seven o'clock, Dr. Ritchie, on Electricity.—Thursday afternoon, Feb. 2, at one, Mr. Sheridan Knowles, on the Drama.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane. — Wednesday, Feb. 1, at half-past eight, T. J. Searle, esq., on the Drama.—Friday, 3, Dr. Birkbeck, on Osteology.

*Aldersgate-street Institution*—Wednesday, Feb. 1, at half-past eight, Dr. Trueman, on Respiration.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Feb 2, at half-past eight, Mr. Sheridan Knowles, on the Drama.

*Islington Literary and Scientific Society.*—Friday, Feb. 3, at eight o'clock, an Essay and Discussion.

*Poplar Institution.*—Tuesday, Jan. 1., G. Francis, esq., on Botany.

*Mutual Institution Society.*—Southampton Coffee-House, Chancery-lane, at half-past eight, Essay on the Trinity.

## QUERIES.

*Varnish for Balloons.*—Doubtless some of your intelligent correspondents can inform me how to make the best and cheapest varnish for balloons—also if there be any particular kind of silk to be used.

G. H. M.

*Sponge.*—What is the specific gravity of dry sponge.

S. T. C.

## TO CORRESPONDENTS.

"Hennicus." The fact is so well known that it is unnecessary we should insert his communication.

"J. C." has been anticipated, as he will see by referring to No. 11.

"M. V." Next week.

We cannot answer the questions of "B." unless he writes more fully upon the subject. From his note we cannot exactly understand what he requires to know—particularly by his second query.

"Mr. Puttick's" letter shall not be overlooked.

All communications for insertion in the "Penny Mechanic," should be addressed "to the Editor," at the Publishers. Some of our correspondents have directed their letters *to the Publisher*, by which means they might have been delayed.

Correspondents who have not been answered, may consider their communication accepted.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

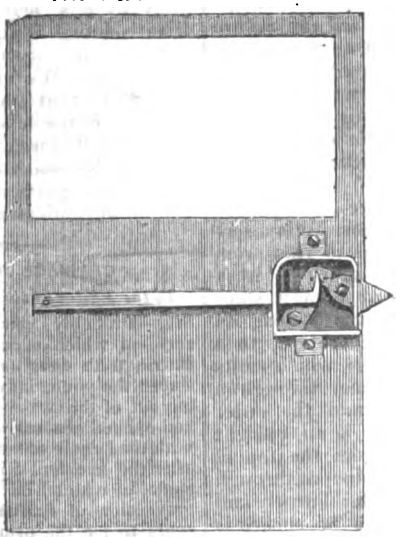
Digitized by Google

# THE PENNY MECHANIC.

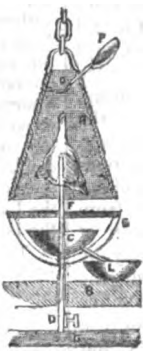
## A MAGAZINE OF THE ARTS AND SCIENCES.

No. XV.] FEB. 4, 1837. Vol. I.

### PATTERSON'S CARRIAGE LOCK.



### GAS COOKING APPARATUS.





Holloway Press: D. A. Doudney.

Digitized by Google

### GAS COOKING APPARATUS.

The practicability of applying gas to other purposes than that of merely affording light, has been frequently discussed; and the great heat gas gives out during combustion, rendered it evidently well calculated to be employed in the preparation of food. A gentleman, of the name of Hicks, in 1831, took out a patent for cooking by gas; and however strange it may appear to many persons, we can assure them we never enjoyed a mutton chop more than when we partook of one prepared in this manner. In some parts of the country gas is employed at taverns for the purpose of cooking; but the patent is very little used in the metropolis.

On the front page we give an engraving of the apparatus. C is a service gas-pipe, supposed to lead from the ordinary street main. D is a smaller pipe, furnished with a stop-cock, leading from C, and passing up through the dresser or table B, to a circular burner marked E, which emits an annular-formed flame, through a fissure cut entirely round the outer surface of the ring. F is an upright spit, rising upwards from the top of the main stem of the pipe D, through the centre of the annular burner, and on this spit the meat to be cooked is placed. G is a small dish at the bottom of the spit, to catch the dripping and gravy, and furnished with a small spout to carry it into a basin, which may stand on the dresser for that purpose, if required. H is a conical metal hood, or cover, open at the top, and suspended over a pulley by a balance weight from the top of the ceiling. The conical hood H being raised, the meat is spitted, and the gas lighted, when the said hood H is lowered over the meat, and the operation of cooking begins; the vapour which rises from the meat escapes at the open top of the cone, and being collected, may be made to escape into the flue of the kitchen chimney. O P is a contrivance for basting. O is a small colander, a piece of metal pierced with holes; and P is a sort of shallow funnel to conduct the dripping into the colander. The dripping is taken from the basin with a spoon, and poured into P, whence it runs into the colander, and is thence distributed over the meat through the holes pierced for that purpose.

It may, perhaps, be supposed that the odour of the gas would make the meat taste unpleasant. This, however, is not the case, at least as far as our experience will allow us to state, and we know gentlemen who have dined where the dinner has been cooked entirely by gas, and they expressed no dissatisfaction, but, on the contrary, stated the meats were cooked exceedingly well. We are therefore rather surprised that the cleanliness and economy of the invention has not obtained for it more extensive patronage. It might be used with great advantage in families, particularly where gas is laid on in gentlemen's houses.

### CARRIAGE DOOR LOCKS.

*To the Editor of the* Penny Mechanic.

Sir,—Probably you may recollect the accident which occurred to one of Lord Barrington's daughters about two years since; the young lady lost her life by falling out of the carriage. It is *supposed* she had opened the carriage door in playing with the handle of the lock. A short time after the accident I invented a lock (the model of which I have enclosed), for the prevention of similar accidents. It appears to me the principle of the lock is adapted for public conveyances on account of the impossibility of the door opening by accident. We, in our walks through town, frequently see the door of a hackney-coach fly open, and not altogether from the insecurity of the lock, but from the neglect of the person who shuts the door in not turning the handle. To obviate this as far as possible, I take the liberty of proposing my lock, if you should consider it worth a place in your excellent Magazine. Before the carriage-door can be opened, the slide which is fixed on the bead of the door must be drawn from the lock, to remove a tumbler which holds the bolt, and prevents its turning till free of the notch. Now it is clear that no accident could occur from the accidental opening of the door by the adoption of this lock, unless it was through the carelessness of the attendant or coachman. I have sent you the above account, believing it might interest some of your numerous readers.

From your obedient servant,
G. A. Patterson.

*Rosoman-street, Clerkenwell.*

Digitized by Google

DESCRIPTION OF THE ENGRAVINGS.

Fig. I. represents the appearance of the lock on the inside of a carriage door. Fig. II. shows the condition of the lock when the door is closed.

The invention above described appears to us well calculated to effect the object intended. The contrivance is extremely simple, and if generally adopted would be the means of preventing many of the accidents that frequently occur, either from carelessness or accident, when the door of a stage-coach, or a family carriage, is left unlocked.

## HILL'S ROTARY PRINTING MACHINE.

*To the Editor of the Penny Mechanic.*

SIR,—About two years ago, when turning my attention to the machines then in use, a plan struck me of affixing the type to a cylinder, and causing it to revolve; since which time I have seen in the list of patents a notice of one granted to Mr. R. Hill; and in the Repertory, or London Journal, I forget exactly which, I saw a plate, containing a view of his machine, as also the specification; but I took it to be merely an improvement of the common machine; and the specification being long I did not take the trouble to read it. I was not aware that it was by fixing the type on the cylinder, till I read the short but clear, account in your work. I will now state the reasons which, two years ago, struck me as bars to its utility, and which will now, in my idea, prevent its use, though brought before the public, viz.—

1. The wedge-like form of the type will render it more difficult to cast. And the wedged form must commence from the very face of the letter.
2. That only one sized press could be used; or, that for every sized press different type must be had, thereby incurring great expense.
3. That the type could not be used with a common press without the inconvenience of wedged leads.
4. The compositors' work would be more difficult.
5. That the advantages gained would fall far short of the disadvantages caused by its use, as a slight consideration of the three first objections will show.

There are many minor disadvantages, but the above I consider as the chief. It may be proper to state that my plan for affixing the type to the cylinder was somewhat different to the one proposed by Mr. Hill. My plan was to have the type cast with a projection on one side and the usual nick on the other, but rather deeper, and into which the projection would fit when the type was composed.

I remain, Sir, yours, &c.,

*Jan.* 18, 1837. C. D. T.

## SHIPWRECKS.

NO. II.

*To the Editor of the* PENNY MECHANIC.

SIR,—If we consider the perpendicular cases, described in my letter in No. XI., as cylinders, we can easily conceive the possibility of these cylinders being each filled with two semi-cylinders; and we may imagine that these semi-cylinders are each cut by perpendicular planes; which planes, when the semi-cylinder is laid horizontally on deck, will form the deck of the semi-cylinder; this will be the first part of a new Life and Cargo-saving Boat. The stern and head of this boat are to be perpendicular planes, with three holes bored through them—one at the bottom, and one at each side, immediately under the deck of the boat. The stowage of these boats is each to consist of internal semi-cylinders, the outer part of which will coincide with the inner part of the C. S. Boat. These cases, for goods, provisions, &c., may be of any given length, from one foot to ten or twenty, according to the size of the vessel, and the nature, size, and quantity of goods in them. In the top of each of these cases there must be a cover, of a circular shape, the diameter of which will be one inch less than the diameter of the case. The receptacle for this cover must be a female screw, and the cover must be a male screw. It is to be screwed in by passing a lever through two eye-bolts, in the top itself, and these eye-bolts are to be made with joints, to stand up perpendicularly when wanted; and when the cover is screwed home the eye-bolts are to fall down, and all are to be flush with the deck.

In right lines with the holes in the ends of the boat, through each case or bale (as described), there must be holes of greater diameter, through these holes circular tubes must pass, and the inside diameter of each tube must be equal to the diameter of the holes at the ends. The head and cutwater, the stem and stern

Digitized by Google

part of this boat, must be of copper, cast or sheet iron, each forming either a semi-globe or the quarter of a globe, with six inches of an end to go immediately over the bow and stern of the boat.

Securing the whole. In the head and stern, horizontal tubes, as described above, must be passed. Then, through all, pass iron, cast metal, or copper rods, the head of each rod being foremost; and let these be secured by nuts and firmly screwed on at the stern.

The stability of this boat will be increased by laying a similar boat parallel to it; and over and under these boats, at convenient distances, pass strong bars of iron, which bars must go over the thwarts of the boats, and at right angles with the decks. These bars having holes with female screws in them, they can be secured by strong bolts. And thus a boat, on this entirely new construction, can be instantly (if previously prepared) got overboard.

The advantages of such boats and of such arrangements must be obvious. Each compartment in the boat being numbered, its contents will be known; and to get at these things nothing is to be done but to unscrew the top of the compartment. For a double boat like this, I conceive there is no necessity for a keel. But, if double boats should be objected to, keels can be put to single boats by means of tubes passing perpendicularly through the internal compartments in them; and all these tubes should be water-proof. The keels being of wood, holes should be bored in them, in a line with the perpendicular tubes; and in the under part of the keels nuts should be counter-sunk, then by bolts, with male screws on their ends, secure the keel, and, so far, all is right. The method of preparing the horizontal railings instantly, and of giving buoyancy to the boat, I will speak of (for the sake of precision) as if the boat were flat-bottomed and straight-sided. Parallel to the sides, and coinciding with them, I would sink perpendicular tubes of cast iron or gun-metal; six or four inches of the top of each of these tubes should be a ferrule-screw; and in this ferrule-screw I would insert my stancheon, to half the depth of the screw, at which place a joint should be that would allow the stancheon to fold down, and the end to be secured with a rope-yarn, to a small eye-bolt on the boat's deck. When the boat will be hoisted up, and laid on the upper deck of the ship, or suspended by tackle from the yards, the stancheons are to be erected, and three inches above the joist are to be screwed home; then, by man-ropes, the stancheons are to be set up.

I remain, Sir, your obdient servant,

M. Rough.

---

Some Members of the *London Mechanics' Institution*, have for some time formed a class for the investigation of the truth and utility of the science of Phrenology. They have lately prevailed upon that most interesting lecturer, Dr. Epps, to deliver a leeture on the science, in the theatre of the Institution, on Thursday Evening, the 9th instant. A small sum will be charged for admittance, for the purpose of raising a fund to be expended in the purchase of such casts, &c. as are necessary to illustrate Phrenology, in order that the studies of those Members of the Institution, who may be desirous of examining the validity of the Phrenological Doctrines, may be facilitated. It is with pleasure, therefore, that we render our Magazine the medium of invitation, to all who may feel interested in the subject. We trust that many may avail themselves of the proffered opportunity, to assist in advancing the cause of truth, by placing the means of setting the validity of a science, which if correct will melitate most effectively against the evils that afflict humanity, within the reach of so many sincere searchers after truth, as must necessarily be included in such a numerous body, as the Members of the London Mechanics' Institution.

---

## MECHANICS' LIBRARY.

*The Education of the Body.—An Address to the Working Classes.*—By Charles Bray. Effingham Wilson.

We have more sound useful information in this very neatly printed pamphlet for sixpence, than can be obtained from many volumes published at a dozen times the price. The education of the body is a subject that well deserves attention, more particularly from that class of persons, who in consequence of the nature of their employments are often afflicted with diseases, which a little knowledge of the structure of their bodies would enable them in a great measure to prevent if not to cure. The writer after making a few remarks upon the question "What is meant by Education," proceeds to describe briefly but perspicuously the structure and functions of the skin, lungs, and stomach; the importance of exercise—the action of the brain and nervous system—and concludes with some sensible observations on Moral and Intellectual Education. From the chapter on "the Lungs," we take the following extract:

"Those who are confined in factories or workshops in any numbers, should get all the exercise in the open air that they can, for to the neglect of this and

Digitized by Google

the consequent want of pure air, is owing the pale faces, langour, weakness, and susceptibility to chest affections so generally observable in operatives, and which make such a difference between them and those who work out of doors.

"Great mischief to the health will arise from too many sleeping in one apartment; almost any sacrifice should be made to prevent this.

"A fire in a small bed-room is unwholesome, and indeed dangerous, because it consumes more vital air than a number of persons together would by breathing. A charcoal fire is particularly dangerous in a bed-room, and injurious everywhere, because it not only takes away large portions of the oxygen, but also generates a great quantity of fixed air, or carbonic acid gas, which is positively poisonous. Many persons rise in the morning with head-ache and great langnor and debility, and this is frequently owing to deficient ventilation in their bed-rooms. Bed curtains are very injurious things when drawn close round a bed.

"A room in which any number have assembled, should never be occupied again until it has been well ventilated, by having its windows and doors thrown open; this should be particularly observed in bed-rooms.

"The ill effects of deficient ventilation can scarcely be calculated, and the suffering resulting from this neglect, in the shape of established delicate health, head-ache, consumption, fever, and various kinds of nervous complaints, is enormous.

"For those who have weak lungs, this care is especially necessary. Considering also the extent of the surface of the lungs, and the quantity of air that is admitted to them, at every inspiration, frequent change of temperature must be very hurtful. In order to lessen the ill effects of this, upon coming suddenly into the cold air, it has been found a good plan to breathe through a handkerchief or something put before the mouth. Dr. Combe says, 'the cold air thus becomes partially heated, and deprived of its moisture in passing through such a medium, and the protection thus afforded is so marked, that few who have tried the precaution will ever afterwards neglect it.'"

*The Connection of the Physical Sciences.* —By Mary Somerville. Third Edition.

THE book before us is one well calculated to stimulate thought and enquiry. Although written by a woman, the Connection of the Physical Sciences is evidently the production of a mind equal in all respects, and in many, superior to that of a man of high intellectual acquirements. Mrs. Somerville is already well known to the scientific reader, by her admirable work on the Mechanism of the Heavens. She is effecting for Physical Science, what the Miss Edworths have done for Moral Science, divesting it of its technicalities, and making it pleasing to, and easy to be understood by all classes of society. The effects of this it is gratifying to contemplate. The book has been eagerly sought after; this is evident from a third edition having been so soon called for, and thus a numerous class of persons, who would be unable to comprehend the sublime truths stated in the work, unless explained in a familiar manner, are enabled, by her exertions, to do so. Mrs. Somerville, like Dr. Arnott, but unlike some who call themselves philosophers, does not wish persons to remain ignorant of science, because they do not happen to have received a mathematical education. As a proof of this we quote the following paragraph.

KNOWLEDGE FOR ALL.—"A complete acquaintance with physical astronomy can be attained by those only who are well versed in the higher branches of mathematical and mechanical science, and they alone can appreciate the extreme beauty of the results, and of the means by which these results are obtained. It is nevertheless true, that a sufficient skill in analysis to follow the general outline,—to see the mutual dependence of the different parts of the system, and to comprehend by what means the most extraordinary conclusions have been arrived at,—is within the reach of many who shrink from the task, appalled by difficulties, which, perhaps, are not more formidable than those incident to the study of the elements of every branch of knowledge. There is a wide distinction between the degree of mathematical acquirement necessary for

Digitized by Google

making discoveries, and that which is requisite for understanding what others have done."

The best means of making our readers acquainted with the character of the work, will be to extract a few passages; this we do, without observing any particular order, but merely giving a few that we marked when reading the book.

IMMENSITY OF THE UNIVERSE.—"The heavens afford the most sublime subject of study which can be derived from science. The magnitude and splendour of the objects, the inconceivable rapidity with which they move, and the enormous distances between them, impress the mind with some notion of the energy that maintains them in their motions, with a durability to which we can see no limit. Equally conspicuous is the goodness of the great First Cause, in having endowed man with faculties, by which he can not only appreciate the magnificence of His works, but trace, with precision, the operation of His laws, use the globe he inhabits as a base wherewith to measure the magnitude and distance of the sun and planets, and make the diameter of the earth's orbit the first step of a scale by which he may ascend to the starry firmament. Such pursuits, while they ennoble the mind, at the same time inculcate humility, by showing that there is a barrier which no energy, mental or physical, can ever enable us to pass: that, however profoundly we may penetrate the depths of space, there still remain innumerable systems, compared with which, those apparently so vast must dwindle into insignificance, or even become invisible; and that not only man, but the globe he inhabits,—nay, the whole system of which it forms so small a part,—might be annihilated, and its extinction be unperceived in the immensity of creation.

"Far as the earth seems to be from the sun, Uranus is no less than nineteen times farther. Situate on the verge of the system, the sun must appear to it not much larger than Venus does to us. The earth cannot even be visible as a telescopic object to a body so remote. Yet man, the inhabitant of the earth, soars beyond the vast dimensions of the system to which his planet belongs, and assumes the diameter of its orbit as the base of a triangle, whose apex extends to the stars. Sublime as the idea is, this assumption proves ineffectual, for the apparent places of the fixed stars are not sensibly changed by the earth's annual revolution. With the aid derived from the refinements of modern astronomy, and of the most perfect instruments, it is still a matter of doubt, whether a sensible parallax has been detected even in the nearest of these remote suns. If a fixed star had the parallax of one second, it would be 215,789 times farther from the sun than the earth is. At such a distance not only the terrestrial orbit shrinks to a point, but the whole solar system seen in the focus of the most powerful telescope, might be eclipsed by the thickness of a spider's thread. Light flying at the rate of 200,000 miles in a second, would take three years and seven days to travel over that space. One of the nearest stars may therefore have been kindled or extinguished more than three years, before we could have been aware of so mighty an event. But this distance must be small, when compared with that of the most remote of the bodies which are visible in the heavens. The fixed stars are undoubtedly luminous like the sun; it is therefore probable that they are not nearer to one another than the sun is to the nearest of them. In the milky way and the other starry nebulæ, some of the stars that seem to us to be close to others, may be far behind them in the boundless depth of space; nay, may be rationally supposed to be situate many thousand times farther off. Light would therefore require thousands of years to come to the earth from those myriads of suns, of which our own is but 'the dim and remote companion.'"

## RAILWAYS.

NO. III.

SUPPOSING that the question relative to the plan on which the railway is to be constructed, has been determined in favour of the system of levels, connected by steep inclined planes; the next thing necessary to be done is to trace a line for the railway, upon a survey of the country, or map, in which we proceed in the following manner:

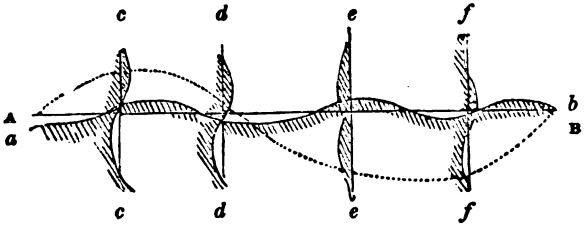
Considering as Geologists do, that the dry land is only that portion of the

Digitized by Google

earth which is sufficiently elevated to rise above the circumjacent waters of the ocean; we should naturally suppose that the general face of the country would rise regularly from the sea shore, to the central parts; in this opinion we are confirmed by the tendency of all rivers to flow towards the sea; sometimes descending many feet perpendicularly, as in the case of a waterfall. Now it also follows, that as rivers are nothing more than the drainage of the country through which they flow, they will, in all cases, occupy the lowest land in the neighbourhood, on account of all water finding the lowest level, thu if we find two rivers, whose direction is nearly parrallel to each other, we may consider that we have some high land between them. Also, when the course of a river is very circuitous, we may consider that the country through which it flows is hilly. And when we find that two rivers commence near the same place, but proceed in two opposite directions towards the sea, that then we have rising land from the sea, to that point in the course of each river. The same remarks may be applied to tributaries, and their tributaries in like manner. With the assistance of these remarks, and a *good* map, such as the Ordinance map, (the finest map that was ever published), Walker's British Atlas, or the maps published under the superintendance of the Society for the Diffusion of Useful Knowledge, some idea may be formed as to the course we should follow to obtain a line of gradients that may suit our road. In these maps which I have mentioned, all the rivers, ridges of high hills, brooks, &c. are accurately marked.

Thus the situation of the two places having been considered as to their probable difference of level, the country between should next be considered, and if it is supposed to consist of high land, the lowest level will be indicated by the drainage, and if hilly, a gap in the chain may be found through which we can conduct our line. Should the intervening land be marshy, and have high land at the back, the best way would be to cross the marsh with a level embankment, and to ascend to a sufficient height to obtain a long level by means of a steep inclined plane, in preference to ascending by means of a long inclined plane with a small inclination per mile, as I have before described. In this manner we ascertain the general nature of the country through which we have to pass, but as the land is generally undulating, the only way to find the best levels is by means of the leveling instrument in the field, with the assistance of judgment, and the eye, or when any particular level is required, with the least cutting and embanking, the line which that line would follow on a map, is found by cross leveling, which is practised in the following way.

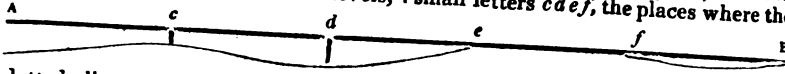
Suppose that it was necessary to find a level or plane with the least cutting and embanking between the two places, A B in the following figure. Draw the line A B, which is the principal line of levels, and the lines, *cc*, *dd* *a*, and *ff* lines, taken at right angles,




with the principal line upon which levels are also taken, the line *a b*, is the section of the country, taken upon the line A B, the other undulating lines represent the sections on the lines, at right angles. Now it will appear by the above diagram, that the amount of cutting would greatly exceed the embankments, therefore, we may take the line of lowest levels indicated in the

Digitized by Google

cross sections, as we have done in the case of the dotted line in the diagram. Now if we take a pair of compasses, and measure off the different levels, one section will represent the following line, where A B represent the level line, as in the first diagram, and the small letters *c d e f*, the places where the




dotted line crosses the other lines, marked with the same letters, and it will be perceived that the difference of the levels is nothing like so great as in the first instance, and consequently there would be much less cutting and embanking, than there would be in the first section.

Having obtained a line that contains the least difference of level, as I have just described, it must be further reduced by means of embanking and cutting. The base of a railway, is the breadth of the top of an embankment, or the bottom of a cutting, exclusive of the drains; and varies from fifteen to thirty feet; embankments and cuttings have their sides sloped, at about the rate of one foot perpendicular, to one foot six horizontal. The cuttings have a drain on each side, about two feet deep; and the embankments a brick drain at right angles to their length, where occasion may require.

Where a ridge of high land intersects the intended line of railway, that cannot be otherwise avoided, tunneling is resorted to, and is approached by means of a cutting at each end. Tunnels should always be avoided where it is possible, both on account of the expense of constructing them, and the public feeling which is not greatly in favour of them; persons connected with these works, would as leave be under ground as above, but this is not the case with every body. Where the railway crosses a brook or stream, a bridge must be constructed over it, for the railway to pass, and where it intersects a turnpike-road, an arch is constructed either over or under the road, as it is exceedingly inconvenient that they should cross upon the same level. In my next I shall describe the rails crossing turnings, &c.

E. F. W.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday evening, Feb. 6, at seven o'clock, Dr. Ritchie, on Magnetism.—Thursday afternoon, Feb. 9, at one, R. Adams, esq, on Acoustics.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane. — Wednesday, Feb. 8, at half-past eight, T. J. Searle, esq., on the Drama.—Friday, 10, J. Cromwell, esq., on the Antiquities of the British Isles.

*Aldersgate-street Institution*—Wednesday, Feb. 8, at half-past eight, Dr. Trueman, on the Voice.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday. Feb 9, at half-past eight, Mr. Sheridan Knowles, on the Drama.

*Poplar Institution*.—Tuesday, Feb. 7., G. Francis, esq., on Botany.

## A QUERY.

VITALITY OF SEEDS.

"Jesse" in his Gleanings in Natural History, states that earth brought up from a depth of 360 feet below the surface, had plants spontaneously shoot up from it.

Is not this a proof that plants have existed in the different strata, and that the seeds which germinate are those of plants that have been prevented doing so previously, from some natural cause?

S.

## TO CORRESPONDENTS.

"J. J. Ritches." The best way would be to get some one who would not object to risk a little money on the invention to advance sufficient to obtain the Patent.—The diagram and letter shall be attended to.

We differ entirely from "Christian-Hackney," respecting the paper to which he alludes.

"W." we think, intended to deceive us. Why did he not say his communication was extracted from the periodical in which it appeared a fortnight ago?

"J. W. Ritchie's" paper and diagram of a safety steam boiler shall be attended to.

"Mr. Wivell's" note, dated the 17th ult., was not received until the 31st. We will write to him in a day or two on the subject.

The press of other matter has prevented our continuing "the Steam Engine." We shall now however do so regularly.

The communications of those Correspondents we have not answered separately, are accepted.

Books for Review and Letters for the Editor, should be sent as early in the week as possible.

A Monthly Part of the Penny Mechanic, price Sixpence, is published with the Magazines.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

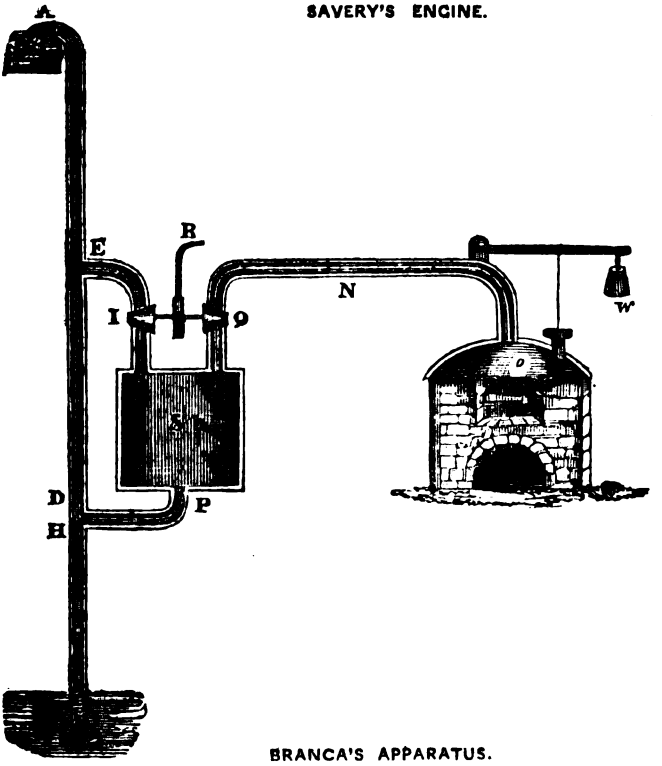
Digitized by Google

# THE PENNY MECHANIC,

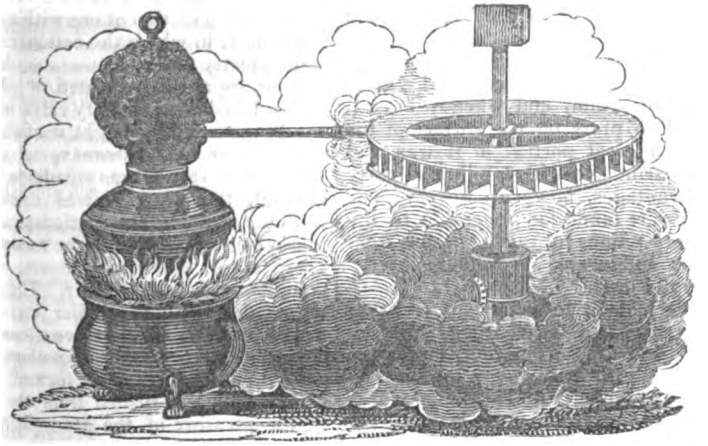
A MAGAZINE OF THE ARTS AND SCIENCES.

No. XVI.] SATURDAY, FEB. 11, 1836. Vol. I.

SAVERY'S ENGINE.




BRANCA'S APPARATUS.





Holloway Press: D. A. Doudney.

Digitized by Google

## THE STEAM ENGINE.

### NO. VI.

THE steam engine constructed by Captain Savery, and described in our tenth Number, may be said to be the first that was ever made applicable for a really useful purpose. It did not, however, accomplish all that was expected. Instead of raising water thirty-four feet high, it was found that the pressure of the atmosphere would not raise it above twenty-seven or twenty-eight feet; and this arose in consequence of the resistance from the vapour formed within the vessels where the steam was condensed, (v v in the engraving of Savery's engine), water is converted into vapour at a very low temperature when in vacuo, and it therefore formed in considerable quantities in the steam vessels, after the steam had been condensed, and a vacuum thereby produced. Another disadvantage was the great danger attending the use of Savery's engine. The high pressure of the steam was occasionally so great that the pipes and condensing vessels were not strong enough to resist it,—they burst, and the most disasterous consequences of course ensued. There was also an enormous quantity of fuel required in order to work the engine with effect. The water was often raised to a temperature of 267°, which of course tended to destroy the apparatus; it was therefore frequently obliged to be renewed. The vessels in which the steam was condensed also had to be raised to the boiling point before fresh steam could remain in it, without being condensed before the time required; this occasioned a great waste of steam, and when it was admitted to press on the surface of the water a great portion of it was also condensed. Notwithstanding all these disadvantages, however, Savery's engines were found far preferable to the ordinary pumps for raising water from mines, and were accordingly pretty generally used.

Savery made an important addition to the means of preventing accidents with steam engines, by inventing what is termed the *gauge pipe*, the use of which is to determine how much water here is at any time in the boiler. If the end of the pipe inside be under the water will be forced up, by the pressure of the steam upon the surface of the water; but if the pipe be above the water, steam only will then escape, and by this means, therefore, the engineers can learn when it is necessary that the boiler should be replenished. In modern engines there are two gauge pipes; one descends as low into the boiler as it is safe ever to permit the water to be; the other pipe terminates above the water; when, therefore, on both the cocks being turned, steam escapes from one and water from the other, the boiler is in proper order, but if steam escapes from both, it shows that the boiler should have a fresh supply of water,—if water escapes from both, there is too much.

Besides this improvement, it was Savery who first suggested the plan of ascertaining the power of steam engines by reference to *horse power*. A horse can raise a certain quantity of water daily, working eight hours a day; an engine capable of performing the same work, in the same time, is said to be of one-horse power, and so in proportion. It is evident, however, that such an engine ought to be called one of *three*-horse power, since it can work the whole twenty-four hours of the day, while a horse is only supposed to work eight.

As the engraving we gave of Savery's engine complete, was rather complex, in case it should not have been thoroughly understood, we give in the front page a section of one with a single condenser, in which the action can be more clearly observed.

This apparatus consisted of a boiler O, furnished with a safety valve M, acting by means of a weight w at the end of the lever, The steam vessel S, into which the steam was made to pass through the pipe N, was connected with the well c by the suction-pipe H P, and when water was to be raised, the vessel s was filled with steam, which completely expelled the air. The communication with the boiler was then closed by shutting the valve Q, and the steam in the vessel becoming condensed, a vacuum was formed, into which the water rushed from the well by the pressure of the atmosphere on

Digitized by Google

its surface. The handle R is used to give motion to the double valve I and Q, the former being intended to admit condensing water from the pipe A D, while the latter alternately opens and shuts the steam communication. In this form of the apparatus the inventor was seldom able to raise water more than thirty feet, and when a greater altitude was required, it was effected by the impelling force of the steam This was accomplished by the ascending pipe A D, which was sometimes carried sixty feet higher than the steam vessel S. After condensing the steam, and filling the vessel S with water, a new supply of steam was introduced, which, pressing on the surface of the water, drove it up the pipe D; but, as we have just stated, it will be evident that this operation must be sometimes very dangerous, as the pressure on the internal surface of the boiler must be in proportion to the height of the column of the water raised by the elasticity of the steam.

If we were treating of the improvements of the steam engine according to their importance, we should proceed to begin with those of our own time, and trace them backward to the time of Hero; but as we are endeavouring to shew the progressive steps by which this stupendous machine has been brought to its present state of perfection, every improvement or suggestion that tended to bring about this result, is entitled to due consideration. It is from this circumstance that we notice the "fire wheel" of Amontons, a Frenchman, which, although too complicated and liable to derangement for any practical purpose, was yet constructed with considerable ingenuity. He proposed rarifying the air in a number of cells, on the edge of a wheel, and by permitting the expanded air to press on the surface of water, situate in a series of cells immediately above those containing the air, he proposed forcing the water into the upper part of the wheel, by this means changing its centre of gravity, and giving it a rotatory motion. Amontons expected to gain immense power by this machine, at very trifling expense; but however well the model may have worked, the machinery was found very inefficient on a large scale. The engine does not appear either to have originated in any other, or to have been improved upon as the inventor's countryman, Papin's, was.

The second engraving on the front page is a representation of Branca's apparatus, which we did not illustrate at the time it was described. The body of the figure is the boiler, and the steam is allowed to escape through the mouth. It is partially condensed by the atmosphere, and the particles of water striking against the wheel, in front of the figure, give motion to it, which was communicated to other machinery and thus made to answer to a useful purpose.

## WARMING ROOMS
### ON AN IMPROVED METHOD.

*To the Editor of the Penny Mechanic.*

SIR,—I was lately very much pleased and gratified in visiting the City of London Free School, situate in Honey Lane Market, near the Guildhall, to observe a very effectual method of warming all the rooms in the house by means of hot water. An explanation of this novel and ingenious mode may not prove altogether unworthy of your columns.

In the cellar or bottom part of the house a large fire was erected, and round this fire was a quantity of pipes about an inch in diameter, forming a kind of barricade round the fire-place. From this range of pipes, other pipes were grafted, which were conveyed to all parts of the house, and laid behind the wainscoting of the rooms, which were made of thin iron, wrought like net work. When the hot water was poured in at one portion of the pipe, it was kept continually boiling by the fire which it enclosed, and the steam passing through all the different pipes which were connected with the rooms, threw out a pleasant and equal heat, which diffused itself through all the apartments, thus precluding the necessity of having fires. The steam that was thus generated, after being condensed into water, returned again to the reservoir at the bottom of the house, where it was again formed into steam and passed through the different rooms

Digitized by Google

as before, thus forming a continual round.

I should think this mode of heating apartments would be peculiarly adapted for public rooms, churches, &c., though in private houses I should prefer a *snug fire-side.*

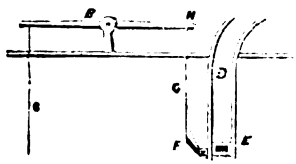
I am, Sir,
Your most obedient Servant,
IOTA.

[The London Mechanics' Institution, and many public buildings are warmed on a similar principle.]—ED. P. M.

## THE STEAM BOILER.

*To the Editor of the Penny Mechanic.*

SIR,—I have just been looking over the plan for improvement of the Steam Boiler by Mr. T. King, and I think that that gentleman's arrangement of the water-valve will not tend to ameliorate the bad qualities of Mr. Douglas' invention in so great a degree as could be wished, if indeed at all. For as the heat is continued, and the expansive force of the steam increased, it will press on the surface of the water (which having no other way of escape) will be forced up the pipe F (See Penny Mechanic Fig. 1. p. 95.) and produce the same effects as Mr. King states would be the result if the pipe F were above the surface of the water, viz. "force up the water valve, and thereby force the float under water, and render it totally useless." To remedy this I would propose the pipe F should be above the surface of the water, having a cock connected with the float as seen in the following sketch.




A portion of boiler, B steelyard, (as in Mr. King's arrangement) C float rod, D pipe, from which water is to be conveyed from any convenient situation into the boiler to supply D, a cock therein, which is to be opened by the handle F fixed to the rod G, at the other end of the steelyard. Now as the water is converted into steam, and the quantity consequently diminished the float will sink; the end H will be elevated, and with it the rod G, which movement will bring the handle F into the dotted position; turn the cock and supply the deficiency which has taken place in the boiler. I think the best form of a float should be that of an inverted basin, and the best material for its constuction, copper.

If you deem the above hasty remarks worthy a place in your useful little work, the insertion will oblige

Your constant reader,
J. F. PUTTICH.

## CAPILLARY ATTRACTION.*

IMMERSE in a vessel of coloured water, one end of a glass tube whose bore is very small, and the liquid will be seen to rise in it and remain above the surface of that in the vessel, which phenomenon is owing to a property in the tube called *Capillary Attraction.* In tubes, whose bores are of different sizes the liquid will rise to different heights, it will rise one inch, and remain at that altitude in a tube whose bore is the fiftieth part of an inch in diameter; but in a tube the bore of which is half that diameter the liquid will rise to double that height, so that the elevation of fluids in capillary tubes, is in an enverse proportion to their internal diameter. It is upon the principle of capillary attraction that water will rise between two square plates of glass; and if they be joined on one side, and kept a little open on the other, the liquid will rise and remain at an unequal altitude, its surface forming a curve. Capillary suspension. also takes place in the adhesion of a drop of water to the side of a glass tube, &c., which evinces that the particles of water have a greater affinity for the particles of glass, than for those of water. The effect of capillary attraction, as exemplified in the above instances is very clear, but the cause of it is not satisfactorily known, the theories of philosophers upon this subject having been different; many affirm that the attraction is at that part of the tube forming a ring round the surface of the liquid in it; and others assert that it acts at the small ring of glass contiguous to the

* *Capillary* is taken from a Latin word singifying *hair*; hence, the bores of capillary tubes are very fine like a *hair.*

Digitized by Google

lower end of the tube; the former opinion seems the most probable, for in the latter case, the rings below the upper surface attract the liquid above them downwards, as much as they attract that below them upwards, consequently there would be no power to support the liquid.

Any liquid that has no attraction for glass, will not ascend in a capillary tube, above the surface of the liquid outside it, but on the contrary, remain below the surface.

The surface of water in a capillary tube is concave, but the surface of any liquid that has no attraction for the tube will be convex.

The ascent of water in sugar, chalk, sponge, &c., is caused by capillary attraction.

S. T. C,

## VENTILATING THE HOUSE OF COMMONS.

SHORTLY after the termination of the last session of Parliament, very extensive alterations in the existing House of Commons, with a view both to ventilation and improved transmission of sound, were commenced under the auspices of Dr. Reid of Edinburgh. In the first place a new ceiling of an entirely novel construction has been interposed between the ancient roof and the floor. The ceiling may be considered as divided into three portions, the centre from one end to the other being perfectly horizontal; the two other compartments are inclined planes, each making with the centre, an angle of about 120 degrees. Those portions of the ceiling which form inclined planes are glazed, while the centre is panelled, to aid in accomplishing the great purpose of ventilation. The side galleries, occupied solely by members, have had their floors materially altered, and an inclination has been given to the ceiling beneath them, which corresponds exactly with the inclination of the lateral compartments in the newly-constructed ceiling above. The strangers' gallery has been advanced and lowered, so that its front row is on a level with the members' side gallery and altogether it is brought more within the body of the House, so that its back forms a much better reflector for sound than heretofore existed. The reporters' gallery has been similarly advanced. The floor of the House itself remains at its original level, but is entirely perforated with small holes in close proximity, in aid of the object of ventilation.

The works having been brought so far near completion as to warrant it, an experiment was made a short time back, with the House filled by men from the foot guards.

Dr. Reid then proceeded to exhibit, by means of a glass model on the table of the House, the operation of his plans. He stated that the main object which he had proposed to himself to achieve was to introduce imperceptibly a constant supply of fresh air, either cool or heated, as the state of the weather or the number of members in the House might require. He pointed out that a short distance beneath the former floor a second floor had been formed, in which were between 20 and 30 large apertures of about 18 inches in diameter. Through these apertures the cool or heated air was in the first instance admitted; and immediately over them were placed large platforms like tables, sustained by short feet, which had the effect of dispersing the great body of air which the large apertures admitted. The air then enters through perforations made in the actual floor of the House, consisting of the almost incredible number of 350,000. They are about the sixth of an inch in diameter on the surface of the floor, but expand downwards in order to prevent their being easily choked or becoming stopped. The egress of the vitiated air is provided for by means of each panel of the centre compartment of the ceiling being raised by blocks several inches above their styles; and it is drawn off by the action of a large circular shaft, which has been erected by Cotton-garden at a distance of about 20 feet from the eastern wall of the building, and constructed so as to contain at an elevation of 10 feet from the earth an exceedingly large coal-fire. The draft created by this shaft draws the air from the roof of the House down a smaller square shaft. The action of both shafts is regulated by dampers.

Dr. Reid tried several experiments, with a view to show the rapidity of circulation through the House:—He first caused the introduction of a smoke so dense that it was impossible to see five yards forwards. In about one minute and a half, by the action of the shaft, it was entirely expelled. He next introduced the odour of ether, which was strongly preceptible to every person present, and dispersed in an equally short space of time by the active but imperceptible introduction of heated air. In like manner was the scent of oranges raised and dispersed. It was reported that during the whole of the experiments the temperature varied only from 60 to 62

Digitized by Google

degrees; but Dr. Reid stated it was quite in his power to lower it to the condition of the outer atmosphere. The acoustics were then tried by speaking and reading in all parts of the House and by various voices, and were pronounced by the gentlemen present to be at all points in the highest degree satisfactory. It ought, however, to be mentioned that there was an absence of that continued murmur or buz which characterises the sittings of the legitimate occupants of the House.

The expense of the alterations is estimated at about 12,000*l.*

HEAT OF THE EARTH.—"The high temperature of mines, hot springs, and above all, the internal fires which have produced and do still occasion such devastation on our planet, indicate an augmentation of heat towards its centre. The increase of density, corresponding to the depth and the form of the spheroid, being what theory assigns to a fluid mass in rotation, concur to induce the idea that the temperature of the earth was originally so high as to reduce all the substances of which it is composed to a state of fusion, or of vapour, and that in the course of ages it has cooled down to its present state; that it is still becoming colder, and that it will continue to do so, till the whole mass arrives at the temperature of the medium in which it is placed, or rather at a state of equilibrium between this temperature, the cooling power of its own radiation, and the heating effect of the sun's rays."

COMETS.—"Only comets with retrograde motions can come into direct collision with the earth, and if the momentum were great the event might be fatal; but in general the substance of comets is so rare, that it is likely they would not do much harm if they were to impinge; and even then the mischief would probably be local, and the equilibrium soon restored, provided the nucleus were gaseous, or very small. It is, however, more probably that the earth would only be deflected a little from its course by the approach of a comet, without being touched by it. The comets that have come nearest to the earth were that of the year 837, which remained four days within less than 1,240,000 leagues from our orbit; that of 1770, which approached within about six times the distance of the moon. The celebrated comet of 1680 also came very near to us; and the comet whose period is 6¾ years was ten times nearer the earth in 1805 than in 1832, when it caused so much alarm. Comets in or near their perihelion move with prodigious velocity That of 1680 appears to have gone half round the sun in ten hours and a half, moving at the rate of 880,000 miles an hour. If its enormous centrifugal force had ceased when passing its perihelion, it would have fallen to the sun in about three minutes, as it was then only 147,000 miles from his surface. A body of such tenuity as the comet, moving with such velocity, must have met with great resistance from the dense atmosphere of the sun, while passing so near his surface at its perihelion. The centrifugal force must consequently have met diminished, and the sun's attraction proportionally augmented, so that it must have come nearer to the sun in 1680 than in its preceding revolution, and would subsequently describe a smaller orbit. As this diminution of its orbit will be repeated at each revolution, the comet will infallibly end by falling on the surface of the sun, unless its course be changed by the disturbing influence of some large body in the unknown expanse of creation. Our ignorance of the actual density of the sun's atmosphere, of the density of the comet, and of the period of its revolution, renders it impossible to form any idea of the number of centuries which must elapse before this event takes place. But this is not the only comet threatened with such a catastrophe; Encke's, and that discovered by M. Biela, are both slowly tending to the same fate. By the resistance of the ether, they will perform each revolution nearer and nearer to the sun, till at last they will be precipitated on his surface. The same cause may effect the motion of the planets, and ultimately be the means of destroying the solar system. But, as Sir John Herschel observes. they could hardly all revolve in the same direction round the sun for so many ages without impressing a corresponding motion on the etherial fluid, which may preserve them from the accumulated effects of its resistance. Should this material fluid revolve about the sun like a vortex, it will accelerate

Digitized by Google

the revolutions of such comets as have direct motions, and retard those that have retrograde motions."

SOMERVILLE.

## TANNING.

THE process of tanning will furnish us with a striking illustration of the power of machinery in accelerating certain processes in which natural operations have a principal effect. The object of this art is to combine a certain principal called tanning with every particle of the skin to be tanned. This, in the ordinary process is accomplished by allowing the skins to soak in pits containing a solution of tanning matter: they remain in the pits six, twelve, or eighteen months; and in some instances, (if the hides are very thick) they are exposed to the operation for two years, or even during a long period. This length of time is apparently required in order to allow the tanning matter to penetrate into the interior of a thick hide. The improved process consists in placing the hides with the solution of tan in close vessels, and then exhausting the air. The effect is to withdraw any air which may be contained in the pores of the hides, and to aid capilliary attraction by the pressure of the atmosphere in forcing the tan into the interior of the skins. The effect of the additional force thus brought into action can be equal only to one atmosphere, but a further improvement can be made: the vessel containing the hides is, after exhaustion, filled up with a solution of tan; a small additional quantity is then injected with a forcing-pump. By these means any degree of pressure may be given which the containing vessel is capable of supporting; and it has been found that, by employing such a method, the thickest hides may be tanned in six weeks or two months.

The same process of injection might be applied to impregnate timber with tar, or any other substances capable of preserving it from decay; and if it were not too expensive the deal floors of houses might thus be impregnated with alumine or other substances, which would render them much less liable to be accidentally set on fire. In some cases it might be useful to impregnate woods with resins, varnish, or oil; and wood satured with oil might, in some instances, be usefully employed in machinery for giving a constant, but very minute supply of that fluid to iron or steel, against which it is worked. Some idea of the quantity of matter which can be injected into wood by great pressure, may be formed, from considering the fact stated by Mr. Scoresby, respecting an accident which occured to a boat of one of our whaling ships. The harpoon having been struck into the fish, the whale in this instance, dived directly down, and carried the boat along with him. On returning to the surface the aaimal was killed, but the boat, instead of rising, was found suspended beneath the whale by the rope of the harpoon; and on drawing it up, every part of the wood was found to be so completely saturated with water as to sink immediately to the bottom.

*The Glazier's Diamond.*—The art of using the diamond for cutting glass has undergone, within a few years, a very important improvement. A glazier's apprentice, when using a diamond set in a conical ferrule, as was always the practice about twenty years since, found great difficulty in acquiring the art of using it with certainty; and, at the end of seven years' apprenticeship, many were found but indifferently skilled in its employment. This arose from the difficulty of finding the precise angle at which the diamond cuts, and of guiding it along the glass at the proper inclination when the angle is found. Almost the whole of the time consumed and of the glass destroyed in acquiring the art of cutting glass, may now be saved by the use of an improved tool. The gem is set in a small piece of squared brass with its edge nearly parallel to one side of the square. A person skilled in its use now files away the brass on one side until, by trial, he finds that the diamond will make a clean cut, when guided by keeping this edge pressed against a ruler. The diamond and its mounting are now attached to a stick like a pencil by means of a swivel allowing a small angular motion. Thus, even the beginner at once applies the cutting edge at the proper angle, by pressing the side of the brass against the ruler; and even through the part he holds in his hand should deviate a little from the required angle, it communicates no irregularity to the position of the diamond, which rarely fails to do its office when thus employed.—*Babbage.*

*Employment of materials of little value.*—The skins used by the gold beater are produced from the offal of animals. The hoofs of horses and cattle, and other horny refuse are employed in the production of the prussiate of potash, that beautiful, yellow, crystallized salt, which is exhibited in the shops of some of our chemists. The worn-out saucepans and tin ware of our kitchens, when beyond the reach of the tinker's art, are not utterly worthless. We sometimes meet carts loaded with old

Digitized by Google

tin kettles and worn-out iron coal skuttles traversing our streets. These have not yet completed their useful course; the less corroded parts are cut into strips, punched with small holes, and varnished with a coarse black varnish for the use of the trunk-maker, who protects the edges and handles of his boxes with them; the remainder are conveyed to the manufacturing chemists in the outskirts of the town, who employ them, in combination with pyroligneous acid, in making black die for the use of calico printers.—*Babbage*

## INSTITUTIONS.

*Mutual Instruction Society.*—This society, meeting at the Southampton Coffee House, Southampton Buildings, Chancery Lane, has been established nearly three years. The members meet every *Thursday* evening at half-past eight o'clock, when one of them reads an essay or delivers his opinion extemporary, on some question in metaphysics, history, theology, &c. A discussion ensues, in which every member is at liberty to take part if he pleases. By this means much valuable information is diffused and a person may acquire the art of expressing his opinions to any number of individuals, without embarrassment. These, however, are not the only advantages offered by the society; it possesses a very good library, and many of the magazines are taken in regularly, which the members are permitted to take home to peruse.

Any of our readers who might wish to join the Society, can do so on applying to the Secretary at the place of meeting, any Thursday Evening. The Subscription is only *One Shilling and Sixpence* per Quarter.

LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday evening, Feb. 13, at seven o'clock, Dr. Ritchie, on Magnetism—Thursday afternoon, Feb. 16, at one, R. Adams, esq., on Acoustics.

*London Mechanics Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Feb. 15. E. Cowper, esq., on paper making.—Friday, 17. T. J Searle, esq., on the Drama; both at half-past eight.

*Aldersgate-street Institution*—Wednesday, Feb. 15, at half-past eight, T. J. Searle, esq., on the Drama.

*Islington Literary and Scientific Society.*—Thursday, Feb. 16, at eight, Dr. Trueman, on Digestion.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday Feb. 16, at half-past eight, Mr. Sheridan Knowles, on the Drama.

*Poplar Institution*, East India Road.—Tuesday, Feb. 14., W. Lukeing, esq., on Electricity, at eight o'clock.

*Society of Arts*, Adelphi.—Tuesday, Feb. 14. the Secretary, on the Metallurgical History of Iron.

*Eastern Athenæum.*—Wednesday, Feb. 15. C. H Purday, esq., on the Music of Various Nations, with Vocal Illustrations, at eight.

## QUERIES.

"W. V." wishes to know which are the best treatises upon Natural Philosophy, Mechanics, Algebra, Geometry, and Trigonometry.'

[Arnott's Elements of Physics.—The Library of Useful Knowledge.—C. Hutton's Course of Mathematics, by Dr. Gregory.—and Lardner's Plane and Spherical Trigonometry, are all useful works on the subjects mentioned.—ED. P. M.]

"J. B." would be glad to learn the best and most economical mode of obtaining a *solution of Indian Rubber*.

Indian Rubber, or Caoutchouc, is soluble in ether, the volatile oils, and petroleum. The ether, however, requires to be washed with water repeatedly, and in this state it dissolves it completely. Pelletier recommends boiling the Indian rubber in water for an hour; then to cut it into slender threads; to boil it again about an hour; and then to put it into rectified sulphuric ether, in a vessel close stopped. In this way, he says, it will be totally dissolved in a few days, without heat, except the impurities which will fall to the bottom if ether enough be employed. Bernard says, the nitrous ether dissolves it better than the sulphuric. If this solution be spread on any substance the ether evaporates very quickly, and leaves a coating of Indian rubber unaltered in its properties. Naptha, or petroleum, rectified into a colourless liquid, dissolves it, and likewise leaves it unchanged by evaporation. Oil of turpentine softens it, and forms a pasty mass that may be spread as a varnish, but is very long in drying.

"An Apprentice, Woolwich," wishes to know what is the best material he can use, in order to fasten together the parts of a cardboard model he is constructing. Glue will not suit, and he wishes to know if any of the readers of the Penny Mechanic can inform him what substance is generally used by persons who construct models.

[Strong gum-water, with a little moist sugar mixed with it, would probably answer the purpose.]

### *To the Editor of the Penny Mechanic.*

SIR,—In answer to the Queries of your correspondents "G. H. M." and "S. T. Q." I beg to inform our former, that an excellent and durable varnish for balloons may be obtained by attending to the following directions.

Dissolve Indian Rubber cut small in *five* times its weight of spirits of turpentine, by keeping them some days together; then boil one part of this solution in eight times its weight of drying linseed oil for a few minutes, and strain; it should be used warm. The silk should be stout and strong, but no particular kind is necessary.

In answer to the other correspondent "S. T. C." the following is a method to ascertain "the specific Gravity of dry Sponge." Weigh accurately the dry sponge, then half fill a quait, (or any other vessel perfectly cylindrical) with water, marking the exact height by an internal line, then insert your sponge, and let it remain in some hours, so as to be completely saturated; mark again the height of the water, and weigh the quantity of fluid between the two marks; deduct the weight of the dry sponge and the result will give you its specific gravity.

BRACK'S BROTHER.

## TO CORRESPONDENTS.

As we are obliged to go to Press early in the week the favour of several Correspondents were obliged to remain unanswered this week.

"F. C. P." Silk, or Tissue Paper. Further directions will be found in the present Number.

We have received several letters containing answers to the Query of "G. H. M," similar to the one we have inserted.

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand, and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,

A MAGAZINE OF ARTS AND SCIENCES.

No. XVII.] SATURDAY, FEBRUARY 18, 1837. Vol. I.

## MECHANISM OF A WATCH.

Fig. 1.

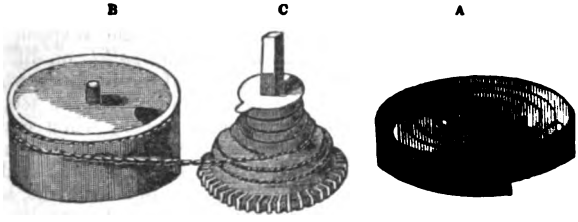



Fig. 2.

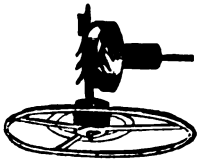


Fig. 3.

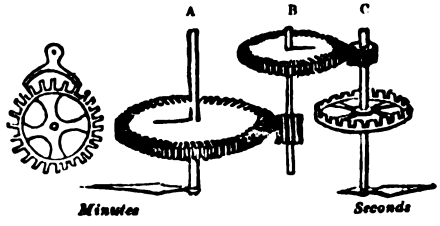
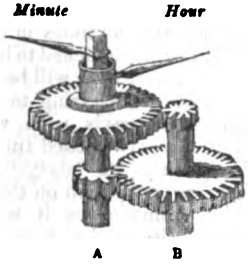



Fig. 4.






Holloway Press: D. A. Doudney

Digitized by Google

### MECHANISM OF THE WATCH.

It too frequently happens that what we have the opportunity of witnessing every day, does not receive half the attention that is bestowed on less interesting objects which have the advantage of being presented to our notice less frequently. How many persons, for instance, will devote a considerable portion of their time and attention to examine a curious fossil, or some other rare production, when they have never taken the trouble of examining, what perhaps they have the opportunity of doing every day—the mechanism of a watch.

Our limits will not permit us to enter into the early history of watches, or to describe the progressive improvements that have been made in them. This subject we must leave for a future time, and at present describe the mechanism illustrated on the first page. We are indebted for the designs to Sir Charles Bell's notes in the last edition of Paley's Theology.

Fig. 1. represents the moving power of the watch. This is the steel spring A, which is enclosed in the *barrel* B, one end being fixed on the axle in the centre of the barrel, and the other to the inner part of it, by which means when the spring uncoils, motion is given to the other works of the watch, which communicate with the hands on its face, as will be presently described. The *Fusee* is represented at C, round this the chain connecting it with the barrel is coiled. When the watch is first wound up, the spring within the barrel is reduced into the smallest compass, and therefore it then of course exerts its greatest force in endeavouring to uncoil itself from around the axle. At this time it unwinds the chain from around the *upper* part of the fusee, and in order to render the force exerted by the spring as uniform as possible; the circumference of the fusee at this part is much less than lower down, and the leverage is consequently less. When the power of the spring loses somewhat of its intensity, from having partially uncoiled itself, its lever power over the fusee is increased by the increased diameter of the latter, and by this very ingenious contrivance the force exerted by the spring during the whole of the time it is unwinding the chain from the barrel is uniform. Its power as a lever increases as its power as a spring diminishes. The fusee alone, however, is not sufficient to render the power of the spring quite uniform. This is effected by the *Scapement*, Fig. 2. Underneath the balance-wheel a finer hair spring is coiled. This spring is alternately pulled and let go by a motion communicated to the wheel, and the spring, by the regularity of its motions, answers the purpose of a pendulum. The notched wheel below is the scapement wheel; two projecting *pallets* on different faces of the axle of the ballance-wheel fall in succession between the teeth of the scapement wheel; when one of these slips off the teeth, and the axle is set free, the spring recoils, and delivers the other pallet into the succeeding notch; and thus the regular motion of the spring, without stopping the revolution of the scapement, regulates the time in which the teeth are let loose, and by this means equalizes the motion of all the wheels. The ballance wheel and spring move with a quickness which permits the scapement wheel to beat 18,000 in an hour—the common rate of a watch that shows seconds. Another form of scapement is shown Fig. 3.

The wheel on the base of the fusee gives motion to the wheel A, which has 64 teeth; these fall into the *pinion* of the third wheel, B, which has 8 teeth, or *leaves* as they are technically called, the wheel itself has 60 teeth; these play into the pinion of the fourth wheel C, which has eight leaves. The central wheel going round once in an hour, the fourth wheel will go round 60 times in an hour, and with the hand attached to its axle it will mark seconds. This will be more easily understood by referring to Fig. 3. The wheel on the axis A, to which the minute hand is attached turns round once in an hour. Its sixty-four teeth play upon the pinion on the axle B; as this has eight leaves it will revolve *once* for every eight teeth of A, and consequently eight times during the whole revolution of A, that is an hour. The wheel on the same axle B, has 60 teeth, which turns the right leaved pinion of

Digitized by Google

c; it will therefore turn the axle c seven times and a half during one revolution or sixty times during the eight revolutions which B makes in one hour.

In order to remove the hour hand, instead of motion being conveyed from the teeth of the wheels to the leaver of the pinion as just described, the reverse takes place, power is communicated *from* the pinions to the wheels. The wheel A in Fig. 4, goes round once in an hour, and the axle of this wheel passes through the dial and has the minute hand attached to it. The pinion of this wheel, called the cannon pinion, has 10 leaves which play, during the hour upon a wheel B having 40 teeth, which accordingly is moved round only once in four hours. The wheel B, has a pinion of 12 leaves working into a wheel of 36 teeth, and must therefore make three revolutions to cause that to revolve once. But as the former B, requires four hours for one revolution, it must occupy twelve in making three, and consequently the 36-toothed wheel will take twelve hours to complete one. To its axle therefore the hour hand it attached. This axle is a cylinder which encloses the axle of the minute-hand so that both revolve, indicating the hours and minutes on the same circle of the dial. We cannot spare the room necessary for a description of the works of the watch complete; these with some further remarks and another engraving, we shall give next week.

## NATIONAL BATHS.

There are few cities in the world so destitute as London of the means for promoting personal cleanliness by means of bathing. This is the more singular, because there is certainly no capital in which cleanliness is more strictly observed, than in our own metropolis. While, however, the inhabitants of Constantinople, and St, Petersburgh, have every facility afforded them for improving their health, and increasing their enjoyments by means of a bath, a denizen of "the metropolis of the world" has till very lately, been almost without this necessary appendage to every city and large town. It is true that those who can swim may enjoy themselves in the Serpentine, but where is the poor fellow who cannot swim to go to, and where those whose constitutions will not allow them to plunge into a cold bath with impunity? Baths are not required only for those who can swim. It is necessary that every person who wishes to preserve health should frequently wash the whole body, and it is in order to enable every one to do this that baths are required. We know however very many persons who never do this, and yet they do not suffer from ill health; it would notwithstanding be folly to suppose that bathing is unnecessary. The skin has a certain office to perform, it throws off a certain quantity of perspiration. The quantity of useless matter thus removed from the system, and also the importance of the function, we have previously described in the first article on the "Human Body," and need not therefore now recapitulate.

But it must be borne in mind that unless the skin is kept in a healthy state, by frequent ablutions, it is not fitted to perform this function in a proper manner: the lungs and intestines are then made to effect what should be done by the excretory vessels of the skin, and from this cause a trifling cold, or slight attack of indigestion, is often productive of most serious consequences; when if the skin had been allowed to perform its proper action, nothing of the kind would have taken place. These facts are sufficient to show the importance of bathing, and it has frequently been regretted by Philanthropic individuals, and members of the medical profession; that the few baths in London, and the high charges for subscribing to them, prevented the great majority of the inhabitants attending so much to the cleanliness of their persons as they otherwise would have done.

We are happy to be enabled to direct the attention of our readers to an establishment which appears calculated to remedy many of the evils just described. We have lately had the pleasure of visiting the *National Baths*, Westminster Bridge Road, where not merely the gentleman, but the mechanic, can enjoy the pleasure of a tepid bath, for a sum that they can

Digitized by Google

both afford. The baths are formed on what was formerly the Lambeth market. The entrance fee to one is a shilling, to the other *three pence*. The shilling bath is 210 feet long and 60 feet wide. The Mechanics' Bath, as it is called, covers 12,000 superficial feet, and is supplied with 10,000 gallons of tepid water per hour. We have been informed that this water in comparison was found much clearer than that supplied to the house for domestic purposes! Now, when it is considered at how great an outlay of capital all this has been effected, we think the proprietors are entitled to much praise for conferring a substantial benefit on the working classes, by enabling them to avail themselves of the advantages of the bath for the trifling charge that is required for admission. We understand that on Sunday mornings, and after 4o'clock in the afternoon, when the baths are open, the number who visit it show how highly the benefit is appreciated. At present this bath is undergoing repairs, but will be opened again shortly. We hope soon to see a similar bath established at the East end of London; we are only aware of one tepid bath—near the City Road, but that is too expensive for the artizan to visit frequently.

It is principally to the mechanics' bath we have described, that we wish to draw attention, but the shilling bath is a noble structure; like the former bath, it is constructed of stone, and contains 107 dressing boxes! It is also lighted with gas, so that the bath can be enjoyed in the evening as well as the morning. There is a cold plunging-bath attached for those who prefer it to the tepid-bath. The whole establishment is certainly on a larger scale than any we have ever seen or heard of in this country.

## ADVANTAGES OF STEAM CONVEYANCE.

COLONEL TORRENS, M. P., in his evidence before a committee of the House of Commons, made the following observations with reference to the employment of steam as a means of conveyance instead of horses. "It has been supposed, that there are employed on the common roads in Great Britain one million of horses; and a horse, it is calculated, consumes the food of eight men. If steam carriages could ultimately be brought to such perfection as entirely to supersede draught-horses on the common roads, there would be food and demand for eight millions of persons. But when we take further into consideration, that lowering the expense of carriages would enable us to extend cultivation over soils which cannot now be profitably tilled, and would have the further effect of enabling us to apply, with a profit, additional portions of labour and capital to the soils already under tillage, I think it not unfair to conclude, that were elementary power on the common roads completely to supersede draught-horses; the population, wealth, and power of Great Britain would at least be doubled."

The evidence of Mr. John Farey, engineer, on the subject, but more particularly with reference to steam carriages on common roads, will be read with interest,

He says, "Steam power will propel a carrage as cheaply at a quick rate as at a slower rate; that fact is proved on railways in actual business: and steam-coaches will be the same whenever they can be made strong enough to bear quick motion without being overloaded with weight of machinery. That will be one of their great advantages over horse labour, which becomes more and more expensive as the speed is increased. There is every reason to expect, that in the end the rate of travelling by steam will be much quicker than the utmost speed of travelling by horses: in short, that safety to travellers will become the limit to speed as is now the case on railways."

"What is your opinion as to impelling waggons by steam?"—"I have never considered that at all in detail, and am not prepared to give evidence upon the subject. The price of carrying passengers or goods at a quick speed, as is done by stage-coaches or vans, will be always so much higher than the prices of carrying an equal weight at a slow speed, as is done by waggons, that I see no inducement to attempt steam-waggons, which I think would present almost all the same difficulties as steam vans. According to theory, the cost of carriage by steam

Digitized by Google

will (as I have stated) be proportionate to weight and distance, without regard to speed of motion; for instance, to convey a coach loaded with two tons for a distance of ten miles only, the same fuel will be consumed and the same wear of machinery will be occasioned whether that distance is run in one hour or in four hours. The wages of engineers, conductor, and guard, will be only one-fourth with the quick speed, and the first outlay in machinery would be only one-fourth, because four times as many engines must be on the road, with their attendants at the same time, to do the work at a slow speed, as at a quick speed; but the money earned by the carrier at the slow speed will be only a small part of what would be earned at the quick speed."

"Taking into consideration the comparative expense of horse-carriages and steam-carriages, do you suppose that steam-carriages will be able to run for half the charges of horse carriages?"—"My own idea is that steam-coaches will very soon after their first establishment, be run for one third of the cost of the present stage-coaches; but to become a business at all, it must necessarily be a business which will offer strong inducements to persons to imbark in it; and to do that, the rate of profit must be very much greater than that which is commonly expected to be realized by the proprietors of stage-coaches; their present trade affords a less profit on the capital and trouble of management probably, than any other sort of business which is carried on with spirit in this country. The great reason of that is the constant loss by destruction of horses, the fluctuations of the price and quality of horse-keep, and the impossibility of reducing stage-coach establishments in times when travelling business is flat; because the horses must be kept and men to attend them at all events, and the loss of running a coach half employed is not so great as suspending it, and keeping the horses idle on short allowance, till better times come round. The profit of stage-coaches which load well is very high, particularly in the fine travelling season, and that occasional profit creates an excitement which induces the injudicious setting up of more coaches than are wanted for an average of all seasons; and for the reasons above stated, their expenses when once set going, cannot be reduced to meet bad times. The adoption of steam-coaches will set the trade free from its great commercial difficulty, because they can be laid up and kept idle without considerable loss, and brought out again when wanted without any new outlay; also fuel does not fluctuate either in price or quality to any considerable extent like horse corn. In short, the capital embarked in a steam-coach trade will not be so rapidly wasted as at present in horses. Owing to the great number of horses which must be first bought and then kept to do the same work as one steam-coach, the first outlay in stock will be very small in steam-coaches, compared with horses, the same of stables, hostlers and harness. The daily expenses of fuel and attendants will be very much less than that of horse keep and attendance; the wear and tear of the coaches and all that is coachmakers' work will be only the same as at present, but the wear and tear of engine and machinery, though a very expensive item on each engine, will be nothing to compare with the present repairs, loss and decay of horses, because the number of engines is so small. Stage-coach horses require to be all renewed every three years, notwithstanding a heavy annual expense for what may be called repairs of horses; viz. harness, shoeing, and farrier. Engines with an equally heavy annual expense of repairs to that of horses will, when perfected, be kept up thereby in such a state as to last for many years without renewal. The metal parts of machinery only wear at particular places, which are capable of being repaired or renewed, so that they become as good as new; but a horse when worn to disease at any part, feet, eyes, or lungs, becomes incapable of stage-coach work for ever afterwards."

## THE HUMAN BODY.

FOURTH ARTICLE.

In our former papers on the Blood, we

Digitized by Google

have described its general and vital qualities; we have now to examine its chemical constitution. Directly it is drawn from the body it coagulates; it separates into a solid called the crassamentum or clot, and a fluid termed serum.

The crassamentum or clot after a short period undergoes a change; the lower portion of it will be found to consist almost entirely of the red particles we have previously described, and the upper part of a substance termed *Fibrin*. The flesh of all animals is composed of fibrin. If we wash a piece of flesh until its red colour disappears, it will be found to resemble in many particulars the fibrin of the blood; and when examined by the anatomist, is found exactly similar to the fibres of which the flesh of animals is composed, when these fibres are divested of their coating of cellular tissue, and red colour. The manner in which the blood forms fibrin, is asserted by several eminent physiologists to be as follows. While the blood is circulating in the web of a frog's foot, or in the wing of a bat, an immense number of minute globules may be observed in it, by the aid of a tolerable good microscope. These globlules are not confined to the blood of such creatures as a bat or a frog only, they exist in our own and consist of a vesicle with an exterior red coating. When the blood coagulates these globules burst; the red covering sinks to the bottom, and the colourless vesicles are said to adhere to each other and form themselves into fibres; these uniting together form muscle. Whether this be a true explanation of the formation of the flesh of animals or not, it is certain that fibrin is one of the most important constituents of the blood. It is found in all organized bodies, even where the blood is colourless, and is therefore evidently more important than the red particles.

The *Serum* or fluid in which the fibrin floats after coagulation. It is composed almost entirely of albumen, and a few salts. Albumen forms the white of egg, and this and the serum of the blood therefore very nearly resemble each other. If we expose white of egg to a certain degree of heat it coagulates; the same effect is produced on serum under similar circumstances. The acid also coagulates it the same as they do albumen. It is rather singular that carnivorous and other ferocious animals have but little serum in their blood, while timid animals, on the contrary, have a great deal. Albumen is the material out of which some of the most important tissues of animals and vegetables are formed. These we shall describe another time.

While the blood is coagulating a vapour rises from it which has been termed the *Halitus*. This is generally considered as a constituent of the vital fluid, although it appears to be merely a portion of the fibrin or red particles in an aeriform state. It is of a most disgusting odour; to it the butchers' shambles owe their unpleasant smell, and after a great battle, the air round the spot where it has been fought is said to be most offensive.

The last constituent of the blood remaining to be described, is what is well known as the gravy of meat. It is termed the *Serosity* of the blood, and may be obtained by coagulating the serum, and after cutting it in slices, subjecting it to pressure. When we place a joint of meat before the fire to roast, the albumen it contains is coagulated, and when we cut it the serosity or gravy is accordingly given out.

We have stated that every portion of the body is formed from the blood, and the reader must have seen that some of the constituents of the body, such as fibrin, exist almost ready formed. The manner in which the other portions of the human frame, such as bone, &c. are formed from the blood, will be better understood if we give the result of the analysis of some of the more important substances of which the body is composed.

Berzelius, the most eminent chemist of the present day, gives the following as the analysis of the blood itself.

RED PARTICLES.

| | |
|---|---|
| Oxide of Iron..... | 50·0 |
| Subphosphate of Iron... | 7·5 |
| Phosphate of Lime and pure Magnesia..... | 6·0 |
| Pure lime ..... | 20·0 |
| Carbonic Acid and loss. | 16·5 |
| | 100 |

Digitized by Google

FILRIN.

| | |
|---|---|
| Carbon | 53·360 |
| Oxygen | 19·685 |
| Hydrodgen | 7·021 |
| Azote | 19·934 |
| | 100 |

SERUM.

| | |
|---|---|
| Water | 905.0 |
| Albumen | 80·0 |
| Muriate of Potass and Soda 6.0. Lactate of Soda and Anima Matter 4·0 | 10·0 |
| Soda, Phosphate of Soda and animal matter | 4·1 |
| Loss | 0·9 |
| | 1000·0 |

Out of these various substances, and a few that are created by their combination with each other, every part of the body is formed: for instance, bone consists principally of albumen and phosphate of Lime, these both exist in the blood; cartilage is only another form of albumen; which also principally constisutes the cellular tissue. Some of the secretions are formed by the decomposition of the components of the blood, and their reunion in different proportions, by which, of course, different substances are produced. The body, however, is entirely composed of oxygen, hydrogen, carbon, and azote. These combinations produce the following substances.

| | |
|---|---|
| 1 Gelatine. | 6 Resin. |
| 2 Albumen. | 7 Sugar. |
| 3 Mucus. | 8 Oil. |
| 4 Fibrin. | 9 Acids. |
| 5 Urea. | |

Some of these exist in the blood ready formed, others are formed out of it, in its passage through the different glands in which the secretions are elemented. It is in the very minute branches of the blood vessels that these changes are produced, and the capillaries have therefore very properly been termed the artificers of the body; the blood is the material but the minute blood-vessels are the builders. It is in them that the blood is changed into different substances we have just described, and a most delightful study it is to endeavour to find out the means by which these extraordinary effects are produced.

## TO BREW CHEAP BEER.

THE following receipts for brewing beer very economically, will probably be acceptable to many of our readers. We found the receipts in a number of the Gardeners' Magazine, and think their correctness may be relied on

West india molasses is the best for the purpose. It is a kind of treacle which is sold as it comes from the West Indies, and is known by a gritty substance at the bottom of the cask, more or less like sand, which substance is, in truth, an imperfect sugar. Common treacle will do as well if the quantity be a little increased, say one pound in six or seven; but the best article of all is the coarsest brown sugar you can get; it is better than the higher-priced for this purpose; and you may use one pound in six less of it than of the West India molasses. It is, however, dearer upon the whole, though still much cheaper than malt. In making beer from unmalted barley, it is necessary to take good care not to use the water too hot, as, if it be, the barley will set, that is, become pasty, and not allow the water to drain off. Be very particular about this; a little oat chaff well mixed with the barley will go a great way to prevent this accident.

1 *Raw Barley and Molasses.*—The use of raw grain with molasses, for making beer, is a most valuable discovery for the middle clases. Put a peck of barley or oats into an oven after the bread is drawn, or into a frying pan, and steam the moisture from them. Then grind or bruise the grain roughly (not fine), and pour on it 2½ gallons of water, so hot as to pain the finger smartly. Mash it well, and let it stand three hours. Then draw it off, and pour on every two gallons nine of water, rather hotter than the last; but not boiling (say not above 180°). Mash the liquor well, and let it stand two hours before you draw it off. Pour on afterwards 2 gallons of cold water; mash well, and draw off. You will have about 5 gallons. Mix 7 pounds of West India molasses in 5 gallons of water; mix it with the wort from the barley; then add 4 oz. of hops, and boil one hour and a half. When cooled to blood heat, add a teacupful of yeast; cover it with a sack, and let it ferment eighteen hours. In fourteen days it will

Digitized by Google

be good sound fine beer, quite equal in strength to London porter or good ale. The nine gallons of beer will cost—1 peck of barley, 1s. 3d.; 7lbs. of molasses, 1s. 6d. to 2s.; 4 oz. of hops, 3d.: in all, 3s., or at most, 3s. 6d.

2. *Malt and Molasses.*—Pour 8 gallons of water at 170° on a bushel of malt. Mash well; let it stand three hours; draw it off, and then add 8 gallons more water at 196°. Mash, and let it stand two hours: add 8 gallons of cold water to the grain, and let it stand three hours and a half. Mix 28 pounds of West India molasses in 20 gallons of water, and boil the whole with 2 pounds of hops for two hours. When the liquor is cooled down to 85°, add half a pint of yeast; cover it with a sack, stir it well, and let it ferment twenty-four hours. In proper time you will have 36 gallons of good ale for—1 bushel of malt, 9s.; 28lbs. of molasses, 6s. to 8s.; 2lbs of hops, 2s.: in all, 17s., or, at most, 19s.

3. *West India Molasses only.*—Mix 14 pounds of West India molasses with 11 gallons of water; boil it for two hours with six oz. of hops. Let it become quite cool; add a tea-cupful of yeast, stir it up, and cover it over with a sack, to keep it warm. Let it ferment sixteen hours, put it into a cask, and keep it well filled up; bung it down in two days, and in seven days it will be fit to drink, and be stronger beer than London porter. This is the simplest of all; a washing copper and a tub, or even a large tea-kettle, only being requisite. Thus 9 gallons of beer can be made:—14lbs. of molasses, 3s., or, at most, 4s.; 6 oz. of hops, 4½d.: in all, 3s. 4½d., or, at most, 4s. 4½d.

A small quantity of copperas, or vitrol of iron, about as much as will lie on the point of a small knife, is in general use, to give beer a head, and make it drink pleasant and lively. It is not necessary, but it is not unwholesome in any respect. —Y. A. B.—*Gard. Mag.*

## AERONAUTIC SOCIETY.

A Society bearing this title has recently been established. Their object is to facilitate the survey of countries, and perhaps make balloons useful in time of war. We are informed that they intend to endeavour to get an act of incorporation, though the capital to be raised is small. We wish they *may* get it!

# INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Thursday afternoon, Feb. 23, at one o'clock, R. Addams, esq., on Acoustics.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Feb. 22, E. Cowper, esq., on Common Weaving.—Friday, Feb. 24, Election of Officers, both at half-past eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Feb. 23, at half-past eight, Mr. Buckingham, M. P., on Oriental History.

*Aldersgate-street Institution*—Wednesday, Feb. 22, at eight, T. J. Searle, esq., on the Drama.

*Islington Literary and Scientific Society.*—Thursday, Feb. 23, at eight, Dr. Trueman, on Digestion.

*Eastern Athenæum*, Stepney Square.—Wednesday, Feb. 22, C. H. Purday, esq., on the Music of Various Nations, with Vocal Illustrations, at eight.

*Poplar Institution*, East India Road.—Tuesday, Feb. 21, W. Lukening, esq., on Electricity, at eight o'clock.

*Westminster Mechanics' Institution*, Grosvenor St., Millbank Row.—Tuesday, Feb. 22, S. Logan, esq., on Phrenology, at eight.

*Kentish Town Mechanics' Institution.*—Monday, Feb. 21, S. Logan, esq., on Phrenology, at eight.

## TO CORRESPONDENTS.

"R. F. R." We shall perhaps be able to make use of his paper for some future Number.

"Swolby," says, "I am desirous of knowing the velocity of ignited gunpowder, supposing an equal quantity placed regularly along a fluited instrument, a distance, i. e. of twenty miles."—How does he expect his query can be answered?

We are much obliged to "J. R. S." for his note.

"Young Balloon's" Letter did not reach us in time for insertion with the others on the same subject.

We shall be happy to do all in our power to assist the "Westminster Mechanics' Institution.

The third letter of "Mr. Rough's" shall be inserted in a Number or two.

A letter "on the evils produced by Machinery, and showing that the working clases have been more injured than benefited by it," shall be inserted next week.

"W." should have written to us by Monday. We are obliged to go to press early in the week.

If the books are forwarded to us by "M. M." we shall be happy to notice them.

The articles of those Correspondents we have not answered individually are accepted.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

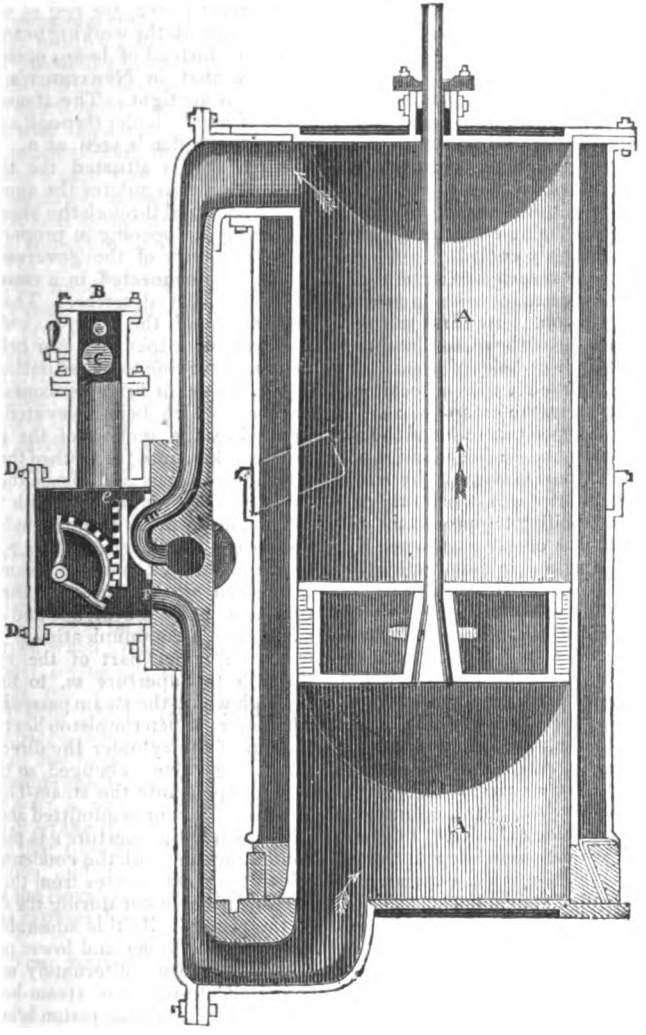
Digitized by Google

# THE PENNY MECHANIC;

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XVIII.] SATURDAY, FEB. 25, 1836. Vol. I.

## DOUBLE-ACTING ENGINE.






Holloway Press: D. A. Doudney.

Digitized by Google

## DOUBLE-ACTING ENGINE.

Of those who have contributed to the improvement of this vast machine, beyond all others must be ranked James Watt, who was originally a mathematical instrument maker in the city of Glasgow. In 1765, he was employed to repair the model of Newcomen's steam-engine, belonging to the university of that place; and while examining this imperfect apparatus, he observed the immense loss of steam occasioned by its admission to the cylinder, just cooled for condensation. He found, that a certain number of cubic inches of steam, generated in the boiler, did not operate as they ought in producing a vacuum. In fact, he ascertained by experiments, that one half of the steam of the boiler was lost by its being condensed in the cylinder previously cooled.

He therefore resorted to several different contrivances in order to prevent this condensation. He first made a wooden bottom to the piston, and then made the cylinder wholly of wood. He afterwards inclosed it with a packing of hemp, to prevent the escape of heat by radiation, and finally introduced the important improvement of condensing the steam in a separate vessel, by which means the cylinder was constantly preserved at the boiling temperature. His earliest model is constructed upon this admirable principal, in the practical development of which, it is stated he received considerable assistance from the celebrated Dr. Black, whose discoveries on the subject of heat then excited the general attention of the scientific world. The first improvement then made by Watt consisted of the addition of a condensing cylinder, into which the steam, after raising the piston, was allowed to pass, by opening a valve, where it condensed without lowering the temperature of the working cylinder. The next great improvement he made was that of making the steam itself depress the piston, instead of the pressure of the atmosphere. This was effected by admitting the steam both above and below the piston, in a manner which may be understood by an examination of the diagram.

When the piston is merely pressed down by the weight of the atmosphere, it is obvious that the pressure cannot be greaterthan about 15lbs. to the square inch.; but by admitting steam above the piston, and thus effecting its depression independent of atmospheric pressure, as in the above diagram, the force with which it is driven down can be increased to an almost unlimited extent.

The cylinder A is furnished with a steam-tight piston, the rod of which is connected with the working beam. This cylinder, instead of being open at the top, like that in Newcomen's steam-engine, is air tight. The steam is admitted from the boiler through a pipe, of which the orifice is seen at B. Below this opening is situated the throttle-valve *c*, which regulates the quantity of steam admitted through the steam-pipe by closing or opening in proportion to the divergency of the governor, with which it is connected, in a manner we shall hereafter describe. The steam passes through the box D D, and enters the cylinder either above or below the piston, according to the situation of the sliding valve, or bridge *e*, contained in the box, which being elevated or depressed by the motion of the toothed arch, working into the teeth of the valve, alternately opens and closes the apertures which communicate with the upper and lower parts of the cylinder. In the figure, the lower aperture P is open to the steam box, and the steam is entering beneath the piston in the direction shown by the arrow, and at the same time a communication is formed from the upper part of the cylinder through the aperture *m*, to the pipe through which the steam passes into the condenser. When the piston has reached the top of the cylinder the direction of the sliding-valve is changed, so that the pipe *m* opens into the steam-box, and the elastic vapour is admitted above the piston, while the aperture P is placed in communication with the condenser, into which the steam passes from the lower part of the cylinder during the descent of the piston. By this admirable contrivance, the upper and lower parts of the cylinder were alternately made to communicate with the steam-box and the condenser, and the piston being both elevated and depressed by the power of steam alone, the machine, in the hands

Digitized by Google

of Mr. Watt, became a real steam-engine. All these improvements were secured to Mr. Watt by right of patent.

*To the Editor of the Penny Mechanic.*

SIR,—Having formerly been the pupil of Mr. G. Pocock, and therefore necessarily having had frequent opportunities of inspecting and riding in his kite carriage, the following brief account of it may be interesting to your readers.

The kites were full five feet in height and proportionably wide, they were covered with linen instead of paper, and had so much power, that one of them could drag a man across a field without his having power to stop himself. They were fastened to the carriage by means of cords, and could be drawn in at pleasure. The carriages were made as light as possible, something in the shape of an invalid's chair, only on four wheels, and capable of containing three persons; they were guided in the same way as a steam carriage.

I recollect about six years ago I travelled from Bristol to Gloucester in one of these carriages in company with Mr. Pocock and a school-fellow, and the greatest difficulty we had to overcome was the hills, as the force required to carry the carriage up a hill, would be too great were it upon level ground, so that one of us was obliged, when we came to any rise, to get out of the vehicle and go behind to help push it up. We were overturned when about two miles from Gloucester, owing to our having turned a corner too sharply, but happily escaped with few bruises, whilst our poor carriage eased of its weight, and having no one to guide it, was dragged with considerable velocity across a field, and we were some time before we were able to overtake it.

Since that time Mr. Pocock has been to London, and showed his carriage to some of the Royal Family, who expressed their approbation of it.

I am, Sir,
Your most Humble Servant,
H. BAKER.

*To the Editor of the Penny Mechanic.*

SIR,—The influence of machinery on the well being of the working classes is so important, that I trust you will allow me to occupy a portion of your magazine with a few observations on the subject; not beeause I presume I shall be able to throw any new light upon it, but knowing your work circulates extensively amongst the working classes, I hope the remarks may be the means of directing their attention to the question that so intimately concerns them.

The opinion that machinery has been productive of more evil than good, is generally entertained by the working classes themselves, and seeing that they are the parties more immediately affected by the introduction of machinery I think their opinion has not been treated with the consideration it deserves. It has been said to be the result of ignorance, and in order if possible to remove it, the Society for the Diffusion of Useful Knowledge, some time ago published a little work, said to be written by Lord Brougham, or Mr. Babbage, entitled, "the Results of Machinery, namely, cheap production and increased employment." Although, Sir, I shall no doubt subject myself to be classed by some persons amongst the ignorant, if not the mischievous portion of society, by the remarks I am about to make, yet I am so firmly convinced of the truth of my proposition, that I shall brave all this, and more—be ready to answer any objection that can be raised against the point I maintain.

This is, that the introduction of machinery has always been more prejudicial than otherwise to the *working classes*. I must beg it to be observed, that I alluded particularly to the *working classes*. That machinery has been highly beneficial to the society at large, that without it we should not possess a tithe of the comforts we now enjoy, and that on its improvement, we must depend for the social, moral, and political improvement of society, I am at once ready to admit; but this does not at all affect the opinion I have just expressed, as I shall presently show.

The term machinery has been applied to every instrument by which man seeks to increase or render more available his physical strength. I might draw a distinction between a tool and a machine, but for the sake of the argument,

Digitized by Google

I am willing to admit that a spade, or a hammer, is as much a machine as the spinning frame, or the printing press. The effects produced on the working classes by their introduction are however widely different. The first may assist without injuring the labourer; the latter by performing his work, necessarily deprives him of his means of subsistence.

Those who look to the more extended employment of machinery for the general improvement of society, point out as one of its greatest advantages, that it lessens the demand for human labour; and, say they, when machines shall be constructed so efficiently that the various servile occupations now performed by human labour, shall be performed by them, then will every man be able to devote himself to the acquisition and diffusion of knowledge, and the greater portion of misery and vice that now exist will be removed! Whether such a consummation "so devoutly to be wished," will ever be effected by machinery, or by anything else, it is not necessary here to inquire, for even admitting it to be probable, it does not in the slightest degree invalidate the proposition I have laid down, on the contrary it confirms it. This I may prove by the first paragraph in the little work, on the Results of Machinery, I have just spoken of. "In the year 1827 the Committee of the House of Commons was appointed to examine into the subject of emigration—that is, to see whether it was desirable and practicable to remove distressed labourers from the United Kingdom to distant places, where their labour might be profitably employed to themselves and others. The first person examined before the committee was Joseph Foster, a working weaver of Glasgow. He told the committee that he and many others, who had formed themselves into a society, were in great distress; that numbers of them worked at the *hand loom* from eighteen to nineteen hours a day, and that their earnings at the utmost did not amount to more than *seven shillings a week*, and that sometimes they were as low as *four shillings*. That twenty years before that time they could readily earn a pound a week by the same industry, and that as *power-loom weaving had increased, the distress of the hand-weavers also had increased* in the same proportion. A power-loom is one worked by machinery, and not by the hand of man. The committee then asked Joseph Foster whether he attributed the insufficiency of the remuneration he received for his labour to the introduction of machinery? To this he answered that he did, but he did not consider the introduction of machinery objectionable, and was perfectly aware that machinery must go on, will go on, and that it is impossible to stop it."

By Foster's evidence we perceive the tendency of machinery. The power-loom can weave more rapidly and economically than the hand-loom, one of the former can, perhaps, supply the place of twenty or a hundred of the latter—the demand for human labour is therefore diminished—but what is the result to the working classes? Why, Joseph Foster who formerly received a pound a week, is glad to get six or seven shillings. Is not the same result to working men invariably produced by the introduction of machinery? Is not the working man invariably the sufferer?

It may perhaps be said, that as machinery lessens the cost of production, therefore, though the wages of the workman may be reduced, yet as he can procure the necessaries and luxuries of life more cheaply, the benefit arising from that circumstance is sufficient to counterbalance the distress occasioned by the reduction of wages. A little consideration will show the fallacy of this assertion. Will any one maintain that Joseph Foster, or any of the hand-loom weavers who are now so dreadfully distressed, can procure the necessaries of life as easily with the trifle they at present earn, as they could when the wages were higher, though the necessaries may have been dearer? If so why are they distressed?

In conclusion permit me to observe, that the great error, I conceive, into which persons fall when considering the effects of machinery, is this—they see the comforts it has procured for themselves—they see that it tends to improve society generally, and they therefore overlook its effect upon the *working classes*. In most cases I know

Digitized by Google

that when the cost of any particular article of manufacture is reduced, there is always an increased demand for it, but this has seldom been sufficient to call again into employment, as the conductors of machines, those who had been thrown out of work when the machines were first introduced, Another class of workmen is then employed; and those who worked on the old plan have to bear all the distress occasioned by the alteration.

I am, Sir,
Your obedient Servant,
S.

## SHIPWRECKS.

NO. III.

*To the Editor of the Penny Mechanic.*

Sir,—In this article I will explain how "the provision, cargoes, and lives of crews and passengers, can be saved from ships that are water-logged," and how they "can be safely brought into port," See p. 85 and 86, P. M.

In explaining my plan, for saving life and property from shipwreck, I will use the cubical yard and the cubical foot, as my measures. Each of these measures must be similar in workmanship, whilst their proportions are as 27 to 1. The measures I speak of, are inside measures, for the cubical yard; and outside measures, for the cubical inside foot.

The Chinese tea-chest is a frail, weak and leaky structure; but a chest made of inch boards, and covered with sheet-iron, with one iron lining in the centre a quarter of an inch thick, and half an inch broad, would be a substantial structure. Let us, therefore, imagine that a chest of this description, one yard every way, inside measurement, is constructed; that the *centre* of the upper face of this cube, is a circle two feet diameter; that the rim of this circle is a female screw, and that the top which fits in it is a male screw. Let us imagine, that four iron tubes, three quarters of an inch inside diameter, are passed through this cube in such a manner, that the outsides of the tubes, will touch the inside of the cube, and that the whole is perfectly water-proof. Now the inside measurement of this cube being one yard, twenty-seven cubes similar in structure, each, one foot outside measurement will fit inside this; and by removing the part of the iron bar, at the diameter of the top face of the great cube, the twenty-seven small ones can be stowed away. Now these twenty-seven boxes, can each be filled with any thing else as well as tea: concentrated meat, bread, or liquors of double, or treble strength, could be preserved in them; by which double the space would be allowed for water, the article most wanted (in general) in case of shipwreck.

In stowing these cubical chests, we will suppose that the lower deck is flat, and without curvature, perfectly horizontal. Any number of them (with, or without the internal cases,) may at the time of stowage be formed into a seagoing raft, and as they are passed forward on the deck on which they are to remain, four iron bars are to be passed longitudinally, through each cube, horizontally.

Assuming the length of this oblong raft to be thirty feet inside measurement, and twelve broad; for the bows and stern of this raft, I would have semicircular chests, the radius of which should be half the outside breadth of the raft. The bows and stern might be all iron, and much stronger than the body of the raft. To the bows should be affixed a cut-water; and to the afterpart a stern post; neither should rise or fall below the level of the cube; but, in the top and bottom of both, screw holes should be sunk, for such purposes as may hereafter be described.

These iron bows, being placed foremost, with similar holes horizontally, in right lines with the tubes, in the cubes, the iron bars being past through all, and through the cutwater, by nuts, the whole is consolidated into one seagoing boat, which is divided into four equal, and two unequal divisions. The union of these four is accomplished as follows, Let horizontal tubes, similar to those described, cross the aforesaid tubes at right angles, and let their outsides coincide with the outsides of the aforesaid internal tubes; by these means, and with the assistance of bars passed through the tubes, the whole will be consolidated.

The entire number of bars for this raft are sixteen long, and forty short. It must here be carefully observed, that the measurement of provision cases of this description, is not of necessity confined to any particular length or breadth; but, on the position of the hollow tubes, the success of all depends: these must be placed in right lines with each other, for if they are not, the raft cannot be consolidated. For the stanchions that are to be set up, in the centre of the outside of each cube, I would sink perpendicular hollow tubes; and the first upper six inches of these tubes should be a female screw, the lower six inches of each stanchion should be a male screw; in the centre of which, or, immediately above the screw, there

Digitized by Google

should be a joint that would allow the stanchion to be turned down on the deck, and secured by a spring that would colapse the eye-bolt. There should be only one stanchion in the centre of the outside of each cube.

The head and stern parts, we will now call the forecastle and poop. In the former, the anchors and chain cables may be stowed; and in the latter, the sails and rigging can be kept. A central case, the whole length of the raft, of any breadth from one foot, to two or three feet, may be reserved for the masts; and this central case, being made stronger than the cubes, the hatches of it will be oblong squares, which may be made into one opening by moveable beams, that can be secured by screws at pleasure. The hatchets may be made to fit in on the upper rim of the central case, and with the solution of India rubber, the whole may be water-proof! The right angular horizontal tubes in the central case, being in right lines with the tubes in the cubes, the central case may be six inches, or nine, or twelve, below the lower part of the cubes. This will answer (if of the proper length), for a step for the cutwater and stern post, in both of which are countersunk holes for screws as before mentioned.

Steps for the mast or masts, (according to the size) may either be made in the bows or poop; or in the central piece; or in all. Now it is evident that all the parts of this horizontal raft, if not covered by lumber or other stowage, can be easily got at, whilst the ship is prosperously pursuing her voyage; but in the event of striking against a rock, the locality of the raft, would occasion the raft and all the cargo, on the present system, to be lost! But, by an improvement on the present system of building, (not in shape but in conveyance) the ship, the cargo, and the crew, in nineteen cases out of twenty can be saved, if made of good timber, or of metal that will not injure the flavour of the tea. The cubical chests will last one hundred voyages to India; and by printing instructions for saving life from shipwreck, and by pasting them on two sides of each cube, large and small, and by covering the whole with a transparent solution of India-rubber, kings, statesmen, philosophers, mechanics, and seamen, could receive that knowledge which would enable them to save life and cargoes from distruction by shipwreck.

I remain, Sir,
Your obedient Servant,
M. Rough.

---

## ADVANTAGES OF STEAM CONVEYANCE.

"Of course, a steam-carriage going slower than ten miles an hour will be more expensive to travel, on account of the greater expenditure of fuel?"—"No; the consumption of fuel, according to time, would be as much less as the motion would be slower; so that the consumption of fuel, according to distance, would be the same, whether for a quick speed or for a low speed; but when profit is considered, every thing is in favour of quick speed; because all goods carried slow must be carried cheap; and quick conveyance will bear the highest price of carriage, on account of the expense of going quick by horses. For instance, a ton of goods may be carried a mile by steam-power with a certain consumption of fuel, but it should take no more fuel to carry it a mile at the rate of two and a half miles an hour than at ten miles an hour; there is some qualification to be made in that statement according to the state of the roads; it will be true if they are hard and good, but if they are heavy, the expense of fuel will be a little more for the quick speed than for the slower speed; and it is to be also understood that the engines must be suitably proportioned for attaining quick speed, because engines which are only adapted for slow motion do not work on so great an advantage when they are urged to work quick, as when they are worked at or below the speed which the proportions of their parts are adapted to move with; nevertheless, that extra expense of going quick by steam-power will be but small, and nothing like the increased cost of travelling quick with horses; for horses have only a limited speed at which they can travel if they have no load to carry or drag after them, the whole of their muscular strength being then required to advance the weight of their own bodies; the speed with which stage-coaches now travel approaches so near to the speed with which the horses could travel without any load, that their force of draught becomes very small. In all cases horses lose force of draught in a much greater proportion than they gain speed, and hence the work they do becomes more expensive as they go quicker. The quickest stage-coach travelling is now at the rate of eleven miles an hour,

Digitized by Google

and that appears to be very near to the utmost limits which nature has prescribed for animal exertion; for those horses require renewal of the whole stock every two or three years. This is a comparison of steam-power and horse labour, during the time that each is actually in operation; but the real difference between the performance of a steam-engine and that of a set of horses will be found to be very great, when it is considered, that by having one spare steam-coach for every two or three which are on the road, those coaches can travel continually all the year round, during fourteen or fifteen hours in every twenty-four hours, without any intermission, except stopping for one or two minutes to take in water at every stage of about seven or eight miles; and thus each steam-coach can travel 140 or 150 miles a-day; whereas a set of four stage-coach horses can only work during seven hours and a half out of every twenty-four hours, or each horse can run fifteen miles a-day, and that exertion wears them out very soon. A cart-horse, travelling at the rate of two miles and a half an hour, can work during eight hours out of every twenty-four hours, or he can travel twenty miles in a day. Suppose that in both cases, of horses going ten miles an hour or only two miles and a half an hour, the force of traction was the same during the time that they were actually drawing; even on that supposition, there would be the difference between twenty miles a-day and fifteen miles a day in favour of slow travelling; but in considering the work performed, the great loss in the force of draught by quick travelling must be taken into account; and it will be found that a cart-horse, walking at two miles and a half an hour, could draw with a force of traction 100lbs. on an average, but that a stage-coach horse, running at 10 miles an hour, cannot exert more than 28lbs. force of traction at an average The above proportions of distance travelled and force of traction exerted in each case being combined into one product, the proportion will stand thus:—20 miles a-day multiplied by 100lbs. draught is equal to 2000, to represent the work done by a horse travelling at the rate of two miles and a half an hour, and 15 miles a day multiplied by 28lbs. draught is equal to 420, to represent the work done by a horse travelling at the rate of ten miles an hour, which is $4\frac{3}{4}$ to 1 in favour of a slow speed; when with steam power there would be only a very slight difference of performance, at the quick or the slow speed.

## MISCELLANIES.

*The Davy Lamp.*—A series of experiments were lately performed at the *Adelaide Gallery of Practical Science*, on the comparative safety of the Davy Lamp, and those invented by Messrs. Newman, W. Martin, and Sir J. Martin. When the lamps were quietly immersed in a compound of hydrogen, common coal gas, and atmospheric air, no explosion took place; but when a jet of these mixed gases were suddenly forced against the lamps, none were sufficient to prevent explosion. Sir John Martin, on behalf of himself and his brother, at once admitted that their lamps were not safe! The subject will be thoroughly investigated by a Committee of the House of Commons this session. The *Mining Gazette*, to which we are indebted for these particulars, states that Mr. Pease, the chairman of the committee, and Major Banks, the Member for Dudley, are both engaged in preliminary operations for bringing the matter before Parliament.

*Mr. Cross's Experiments.*—In reference to the experiment of this gentleman, described in Number 14 of the Penny Mechanic, one of his friends has written to the Newspapers, stating, that Mr. Cross had written to him denying the truth of the statements published as an account of the experiments, and giving altogether a new version of the story. The spontaneous production of the insects is however asserted to have taken place, though under very different circumstances to those detailed in the newspapers. What a pity it is Mr. Cross does not write *himself* to some of the leading philosophical journals, and elucidate this matter. His not doing so is really surprising, considering how much discussion has taken place on the subject.

*The Greenwich Railway.*—The number of passengers have surprisingly in-

Digitized by Google

creased within the last fortnight. During the fine weather the carriages have been quite filled with passengers. This looks well for the future success of this railroad!

*School of Design.*—A council has been formed for the purpose of making the necessary preliminary arrangements for opening this institution. Amongst the names we perceive those of Messrs Calcot, Cockerell, Eastlake, Sir Francis Chantery, all Members of the Royal Academy, also several members of Parliament; and Mr. Pellatt, the glass manufacturer; Mr. Thompson, of Clithero, calico printer, and Mr. Alderman Copeland, M. P., china warehouseman. The school will be opened as soon as possible.

*Zoological Society.*—At the last general meeting the receipts of the past month were announced as 2146*l.* 12s. 2d., and the expenditure 1019*l.* 6s. 3d. several presents were announced both to the menagerie and museum, and the number of visitors to the former was stated as 1666, from whom 42*l.* 14s. was received, and to the latter, 219, the sum received being 4*l.* 1s. It was also stated that Mr. Yarrell, who has officiated as Secretary since the decease of Mr. Bennett, has agreed to retain that situation, without emolument, provided an Assistant Sec. be appointed, which the council are taking steps to provide. The number of mammalia at the Gardens at the last report was 298; the number received since was 5, and the number of deaths 9, making a present total of 294; the birds at the former date were 702; those received since were 4, and the number of deaths were 13, making a present total of 663; and 3 reptiles had been added, making 27: the present total of stock being therefore 1008.

*Diamonds.*—A. M. Perrot, of the Royal Academy of Sciences at St. Petersburgh, after a careful examination of perfect and imperfect diamonds, is of opinion that they are formed by some volcanic action on small pieces of carbon, or of a substance composed of a large portion of carbon and a very small quantity of hydrogen.

## INSTITUTIONS.

*London Institution*, Finsbury Circus.—Monday, Feb. 27, C. Clark, esq., on British Poetry,—Thursday, March 3, R. Addams, esq., on Acoustics, at seven o'clock.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, March 1, Quarterly Meeting.—Friday, March 8, E. Cowper, esq., on Weaving, at half past eight.

*Aldersgate-street Institution*—Wednesday, March 8, at eight, T. J. Searle, esq., on the Drama.

*Western Literary and Scientific Institution*, 47 Leicester-square,—Thursday, March 2, at half past eight, Mr. Buckingham, M. P., on Oriental History.

*Eastern Athenæum*, Stepney Square.—Wednesday, March 1, J. H. Elliot, esq. on the Education of The Senses, at eight.

*Islington Literary and Scientific Society.*—Thursday, March 2, Mr. Downs, on Steam Power, at eight.

*Westminster Mechanics' Institution*, Grosvenor St., Millbank Row.—Wednesday, March 1, R.Fd. Showler, esq., on the Circulation of the Blood, at eight.

*Poplar Institution*, East India Road.—Tuesday, Feb. 28, S. Logan, esq., on Phrenology, at eight.

*Kentish Town Mechanics' Institution.*—Monday, Feb. 27, F. H. Showler, esq., on the Circulation of the Blood, at eight.

## TO CORRESPONDENTS.

"Mr. John King." If it is wished to exhibit the Model, we know no better place it can be taken to than the Adelaide Gallery of Practical Science, Strand. This Correspondent was by mistake called "T. King," in Number Nine.

"F. P. S.,' The Loadstone has an attractive power: how this is communicated to steel is a mystery.

We are much obliged to "Mr. Cooper," and shall probably be able to make use of his paper shortly. The query shall be answered by an article on the Phenomenon.

"Mr. Wivell" is not forgotten, but an unforseen event has prevented our attending to his request.

"A City Apprentice." The Pole Star may be found by means of two stars in the constellation of "the Great bear," which point directly to it. If "a City Apprentice" does not know "the Great Bear," he had better apply to some intelligent friend.

We will find room for Mr. Baker's letter on "Land Skates."

Ritchie's 'Perpetual Motion" shall be inserted shortly.

"King's Force Pump" and "Mode of Filling Steam Boilers" are ingenious. They shall both appear the first opportunity.

Every body thinks they can do two things better than any one else, viz. Stir a Fire, and Govern the Nation. We have no doubt "A Young Gentlemen," can do both far better than the friend, whose manner of using the poker so much offends our correspondent.

The continuation of the article "on the Mechanism of a watch," is omitted this week from press of other matter, but it shall appear in the next Number.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

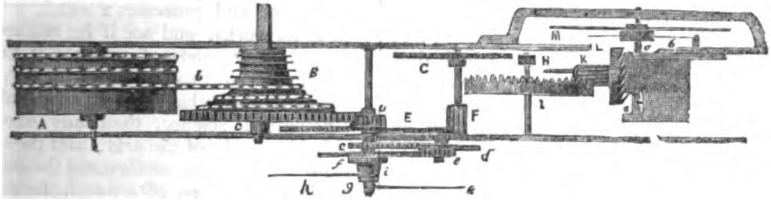
Digitized by Google

# THE PENNY MECHANIC.

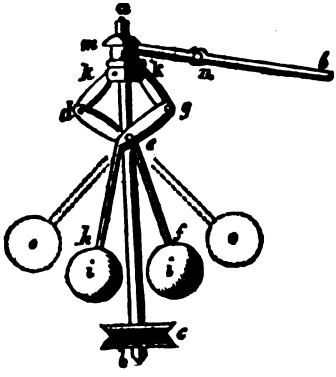
A MAGAZINE OF ARTS AND SCIENCES.

No. XIX.] SATURDAY, MARCH 4, 1837. Vol. I.

MECHANISM OF A WATCH.



THE GOVERNOR BALLS.



Vol. I.—No. XIX. Holloway Press: D. A. Deudney.

Digitized by Google

## MECHANISM OF A WATCH.

NO. II.

HAVING described the different parts of a watch in our former paper on this subject in Number 16, we have now only to explain the manner in which these parts are connected with each other in order to produce the desired result, a measure of time, and our description of the mechanism of a watch will be complete. We have avoided treating the subject in any but a popular manner, because we know many persons have been frightened from inquiring into this, and many other subjects equally interesting and important, in consequence of meeting with technical terms which they could not easily understand. We have heard many persons complain of this in descriptions of the construction of watches, but we think if our readers will take the trouble to peruse the previous description we have given on this subject, they will then perfectly understand the following account of the engraving on our first page.

A is the barrel; B, the fusee; *b*, a flexible steel chain which communicates the motion of the barrel, caused by the spring within it uncoiling, to the fusee C in the great wheel; D, is the pinion (called the cannon pinion) of the second or centre wheel designed to revolve once in an hour. E is the centre wheel, containing sixty-four teeth; F the pinion of the third wheel containing eight leaves; above this is the third wheel marked C containing sixty teeth. N is the pinions of the fourth wheel containg eight leaves. This fourth wheel containing sixty teeth is marked I; and the pinion of the balance wheel, or scapement wheel, as it is sometimes called, containing six leaves, is seen at K. L is the balance wheel containing fifteen teeth, which operate upon the pallets of the balance, and give to it its oscillating motion, these pallets are marked *a a* M. The balance *b*, the hair spring; *c* pinion of ten teeth revolving once an hour; *d* wheel of forty teeth revolving once in four hours; *e* pinion of twelve teeth; *f* wheel of thirty-six teeth revolving once in twelve hours; *g* the end of the axis of the centre wheel upon which the minute-hand *h* revolves; *i* is the axis of the hour wheel upon which the hour hand goes round once in twelve hours.

All this complex machinery is confined in the small space of a pocket watch! When watches were first introduced into this country they were as large in diameter as a cheese-plate, and even larger! Yet, by the ingenuity of our mechanics, all the works have been so beautifully adapted to each other, and such great improvement has been made in their construction and arrangement, that they perform the desired operation far better than those of greater size.

We hope every one who reads this description, and possesses a watch, will look at its works, and see if he can understand their mode of action. If has been justly said that watchmaking combines more of mechanical ingenuity, with mathematical science, than any other within the circle of the arts; and therefore, if a person can understand the construction and action of a watch, he will make himself master of much that belongs to the former of these sciences, if not to the latter also.

One of the most useful improvements in the construction of watches has been the introduction of what is termed the going-fusee. By means of this the action of the works is continued whilst the watch is being wound up, although the principal spring, chain, &c. cease to have any power during this time. As it is highly important that a watch should not cease going while it is being wound up, the ingenious contrivance by which this is prevented, has proved exceedingly useful.

The watch, as we have just described it, is quite sufficient to keep correct time, provided it is always of one temperature, and has friction provided against as much as possible. The latter is effected in a great measure, in good watches, by their being jewelled; that is, having the axis of the balance wheel move on a diamond; but in order to provide against the effects produced by change of temperature more mechanism is required. It is well known that all metals are expanded by heat, and contracted by cold; and it must be evident that this expansion and contraction of the works of a watch will meterially interfere with their action, and cause the watch to indicate incorrect time. Time-pieces where this is provided against, are termed chrono-

Digitized by Google

meters. There are various methods by which the power of the spring is prevented being much influenced by change of temperature; one frequently employed is the different contracting power of different metals; the contraction of brass, for instance, being made to compensate for the contraction of steel. The perfection to which chronometers have been brought by these means is perfectly astonishing, some will not vary one second in a twelvemonth! This excellence has no doubt, in some measure, been produced by the prizes that have been bestowed on the makers of the best chronometers, but it is mainly owing to the skill and intelligence of English artizans.

### THE GOVERNOR.

The contrivance by which Mr. Watt regulated the speed of the steam-engine, and which he called the Governor, is perhaps one of the most ingenious, and at the same time simple, mechanical inventions known.

The two balls *i i* are supported by the bent levers *h e g* and *f e d*, which are attached to a vertical rod *a b*, turning on pivots at its extremities, and put in revolution by a hand passing round the pulley *c*. The upper ends *d* and *g* of the levers are connected by the links *k k* with the sliding piece *m*, which moves freely on the spindle *a b*. When the balls *i i* are in contact with the spindle, the slide *m* is at its greatest height on the rod; but when the balls diverge from the rod, as at *o o*, by the centrifugal force, the slider is depressed, and the extremity of the lever *l* moving upon a fixed pivot *n*, is proportionably elevated. This lever, being connected with the throttle-valve of the steam-engine, closes or opens it in proportion to the centrifugal force with which the balls diverge from the centre. Thus we find, that the same power which regulates the motions of the planets, and by preventing them from flying beyond their prescribed orbits, preserves the harmony of the great frame of nature, is applied, by a simple piece of mechanism, to regulate the operation of the powerful agent by which the steam-engine is moved.

It may be proper to state, that the centrifugal ball, or governor, was first employed by Mr. Bunce, and formed part of a model of an improved crane presented by that gentlemen to the Society for the Encouragement of Arts. Mr. Bunce says, "My design is, instead of a pair of bellows, to have a ball so connected to a small horizontal wheel, that when the machine moves too fast, it may, by its centrifugal force, throw a stop upon the wheel."

### UNDULATORY THEORY OF LIGHT.

The propagation of light through space, not instantaneously, but in time, established by incontrovertible astronomical evidence, leads us to one important element in the theory of its nature, a motion of progression. Other facts disclosed by experiment, principally the singular and paradoxical fact of the interferences, compel us to admit also another condition of motion combined with the last, viz., that it must be of an alternating or reciprocating nature, analogous to vibrations of some sort, since such motions alone can, by superposition, neutralize each other; this is a conclusion from facts quite independent of any hypothesis as to the particular constitution of an ethereal fluid, etc. We do not intend here, however, to enter upon any discussion of the merits of the theory of waves, but merely to offer such a general account of the researches lately made in connection with it, as may be necessary for exhibiting fairly the existing state of the question; and it is in fact one in which almost every part of the science is more or less implicated.

As, however, difficulties are felt with regard to the primary conception of the undulations, we think our readers will excuse us in presenting to them a very brief but luminous illustration of the first general notion of this theory, which we extract in the graphic and glowing language of Sir W. R. Hamilton from the introduction to one of his profound memoirs; as follows:

"This is the theory of Huyghens, who compared the gradual propagation of light, not to the motion of a projectile, but to the spreading of sound through air, or of waves through water. It was according to him, no *thing* in the ordinary sense, no *body* which moved from the sun to the earth, or from a visible object to the eye; but a

Digitized by Google

state, a motion, a disturbance, which was first in one place, and afterwards in another. As when we hear a cannon which has been fired at a distance, no bullet, no particle even of air, makes its way from the cannon to our ears, but only the aerial motion spreads, the air near the cannon is disturbed first, then that which is a little further, and last of all the air that touches us. Or, like the waves that spread and grow upon some peaceful lake, when a pebble has stirred its surface: the floating water-lilies rise and fall, but scarcely quit their place, while the enlarging wave passes on and moves them in succession. So that great ocean of ether which bathes the furthest stars, is ever newly stirred by the waves that spread and grow, from every source of light, till they move and agitate the whole with their minute vibrations: yet like sounds through air or waves on water, these multitudinous disturbances make no confusion, but freely mix and cross, while each retains its identity, and keeps the impress of its proper origin."

This then is the fundamental conception of a theory which has received fresh proof of the readiness of its application at almost every successive discovery of experimental phenomena, and which has been well characterized by Sir J. Herschel as being "in all its applications and details one succession of felicities, insomuch that we may almost be induced to say if it be not true it deserves to be so."

In a theoretical point of view, it has received its most important improvements in the hands of Young and Fresnel, and more lately from the analytical skill of M. Cauchy. This last-named mathematician has in fact remodelled it, as it were, in some of its first elements, and by this means has enabled it to apply to some most important cases where it was previously defective. In fact, to the remark just made as to the general excellence and ready application of this theory there was one grand exception, which presented an apparently insuperable objection to its admission as a real physical theory, the nature of which will appear from the following conditions:

According to the principles of undulations, a ray of light on entering a denser medium is retarded, and this precisely in proportion to the refractive power of the medium. It is a direct consequence from this, that the ray is bent from its original course precisely in that degree which is expressed by the well-known law of refraction discovered by Snell, that the sines of incidence and refraction are in a constant ratio. It is also a consequence of the theory as ordinarily conceived, that whatever we suppose to be the length of a wave, as the refraction depends solely on the diminished velocity of propagation of the waves, it ought to be exactly the same for waves of all lengths. Now the distinction between the different primary rays of light consists in their having waves or periods of different lengths, the red being longest. In the ordinary theory then the equal refrangibility of all the primary rays was a necessary consequence. And thus it was manifestly contrary to one of the most primary experimental truths. But at least no rival theory succeeded in offering an explanation at all more reconcilable with facts. The course then to be pursued was clearly to review the first elements of the theory, and to see whether they might not be so modified as that, while they continued to express as well as before all the experimental laws to which they had been found applicable, they should likewise embrace this case; this was accordingly attempted by M. Cauchy. This distinguished analyst had in several profound Memoirs (published in his Exercices de Mathématiques) investigated the mathematical conditions of a medium similar to the supposed ether of the undulatory theory. In a subsequent Memoir (entitled "Mémoire sur la dispersion de la Lumière, Paris, 1830) he pursued the ideas before laid down, and by a more refined analysis succeeded in establishing such a view of the system of undulations as included the desired *relation between the length of a wave and the velocity of its propagation.*—*Brit. Annual.*

## IMPROVED CONDITION OF THE WORKING CLASSES.

FIRST ARTICLE.

THE industrious classes in this country

Digitized by Google

have seldom been more comfortably situated than at the present time. The price of all the necessaries of life are lower than they have been for many years, and though in some cases the wages of workmen are much less than they ought to be, yet on the whole we think the working classes generally may congratulate themselves on the improvement that has taken place in their social and political condition.

Those who have never had the opportunity of learning what their condition was a century or two ago, will no doubt be astonished to learn the abominable manner in which they were treated. Before the invasion of this country by William the Conqueror, Wade states that two-thirds of the people were either absolute slaves, or in an intermediate state of bondage to the remaining third. They might be put in bonds and whipped; they might be branded; and on one occasion are spoken of as if actually yoked: it is said "Let every man know his *team* of men, of horses, and oxen." The treatment of the people at this period, was more like that of beasts than men. The horses of the higher classes were, indeed, much better taken care of.

After the conquest their condition for a long time was not improved. They were the slaves of the owners of the soil, and as such could be bought and sold. While the people were in a state of slavery, it may be readily conjectured, that their diet would be the mere offal and refuse of their masters; and no more of it than was necessary to enable them to support their daily toil. At this period, the food of labourers consisted principally of fish, chiefly herrings, and a small quantity of bread and beer. Mutton and cheese were considered articles of luxury, which formed the harvest-home, of so much importance in ancient times. Wages were a penny a day in harvest, and a halfpenny at other seasons: the average price of wheat was 6*l.* 8*s.* a quarter, which last clearly shows the small progess made in tillage husbandry, and how little the present staff of life entered into the general consumption of the community. Their habitations were without chimneys, and their principal furniture consisted of a brass pot, valued from one to three shillings: and a bed valued from three to six shillings. The variations in the prices of commodities were great and sudden, arising from the absence of commercial middlemen, whose pursuits, though often viewed with prejudice, tend to produce a regular and equable supply of the most essential articles of consumption throughout the year. The trade of a corn-dealer seems to have been unknown; nor, except in the Abbey-Granges, do we meet with instances of corn being collected in large quantities. The natural consequence must have been, that the farmers, without capital, disposed of their crops at moderate prices, soon after the harvest: purchasers who only looked to their immediate wants, having corn cheap, were naturally wasteful and improvident in the consumption: the price, therefore, almost invariably rose as the year advanced, and was frequently at an enormous height just before harvest, when the supply of the preceding season was nearly or entirely exhausted. Stow relates, that in 1317 the harvest was all got in before the 1st of September; and that wheat which had before been at 4*l.* the quarter fell to 6*s.* 8*d.*, a twelfth part of the price. A reference to tables of prices furnish abundant proof of the extreme misery of these times, in which, the only buyers of corn were the consumers: and no monopolists, as they are termed, interfered, who by the aid of superior capital, purchasing the redundant produce of one year, made a provision for the scarcity of another.

In 1349 England was visited with a dreadful pestilence, which swept from its surface nearly one-half the inhabitants. After this terrible calamity labour became extremely dear, and labourers demanded unusual wages. To remedy this evil a proclamation was issued to fix the price of labour; this not being attended to, the famous *Statute of Labourers* was enacted to enforce obedience by fines and corporal punishment. The statute states, that since the pestilenee no person would serve unless he was paid double the usual wages allowed five years before, to the great detriment of the lords and commons; it then provides that in

Digitized by Google

future carters, ploughmen, plough-drivers, shepherds, and swineherds, and other servants, should be content with such liveries and wages as they received in the 20th year of the king's reign and two or three years before; and that in districts where they had been severally paid in wheat, they should receive wheat or money at the rate of tenpence a bushel, at the option of their employers; they were to be hired by the year and other accustomed periods, and not by the day; weeders and haymakers were to be paid at the rate of one penny, mowers fivepence per acre, or fivepence a day; reapers during the first week in August twopence a day, and from that time till the end of the month threepence a day, without diet or other perquisite. Labourers of this description were enjoined to carry their implements of husbandry openly in their hands to market-towns, and to apply for hire in a public quarter of the town. This unjust interference with the freedom of industry was repeatedly confirmed by succeeding parliaments; and the same erroneous principle of legislation, further extended by the law of 1363, which regulates the diet and apparel of labourers; and that of 1388, which prohibits servants from removing from one place to another; and finally, to conclude those oppressive enactments, justices of peace were empowered to fix the price of labour every Easter and Michaelmas, by proclamation. As a specimen of the absurd system of legislation prevalent at this time, we may mention the minute regulations of the statute of 1363; which directs that artificers and servants shall be served once a day with meat and fish, or the waste of other victuals, as milk and cheese, according to their station; and that they should wear cloth of which the whole piece did not cost more than twelvepence per yard. The cloth of yeomen and tradesmen was not to cost more than one shilling and sixpence per yard. Carters, ploughmen, oxherds, neat-herds, shepherds, and all others employed in husbandry, were to use no kind of cloth but that called black russet, twelvepence per yard. Clothiers were commanded to manufacture the necessary kind of cloth, and a tradesmen to have a sufficient stock upon hand at the established legal prices!

## PROPERTIES OF MATTER.

### DIVISIBILITY.

We cannot imagine any limit to the divisibility of matter, and, speaking theoretically, it is indeed infinitely divisible, since we can conceive that every atom, however small, may be divided into two or more portions. Dr. Dalton's experiments have however pretty clearly demonstrated that the particles of matter which unite to form different substances, have a definite size, and will only combine together in certain proportions. It is of course impossible to give any idea of the size of these ultimate atoms, they are only to be seen by "the mind's eye," but the fact that they are of a definite size is placed beyond all doubt by the investigations of the philosopher just mentioned.

A few instances of the wonderful division of matter will best explain the subject.

A single pound of cotton has been spun into a thread 76 miles in length; and the same quantity of wool has been extended into a thread of 95 miles; the diameters of those threads being hence only the 350th and 400th part of an inch.

But the ductility of some metals far exceeds that of any other substance. The gold-beaters begin with a riband an inch broad and 150 inches long, which has been reduced, by passing through rollers, to about the 800th part of an inch in thickness. This riband is cut into squares, which are disposed between leaves of vellum, and beat by a heavy hammer, till they acquire a breadth of more than three inches, and are therefore extended ten times. These are again quartered, and placed between the folds of gold-beaters' skin, and stretched out, by the operation of a lighter hammer, to the breadth of five inches. The same process is repeated, sometimes more than once, by a succession of light hammers; so that 376 grains of gold are thus finally extended into 2000 leaves of 3·3 inches square, making in all 80 books, containing each 25 leaves. The metal is, consequently, reduced to the thinness of the 282,000th part of an

Digitized by Google

inch, and every leaf weighs rather less than the 5th part of a grain. Silver is likewise capable of being laminated, but will scarcely bear an extension above half that of gold, or the 150,000th part of an inch thick. Copper and tin have still inferior degrees of ductility, and cannot, perhaps, be beat thinner than the 20,000th part of an inch. These form what is called *Dutch leaf*.

In the gilding of buttons, five grains of gold, which is applied as an amalgam with mercury, is allowed to each gross; so that the coating left must amount to the 110,000th part of an inch in thickness. If a piece of ivory or white satin be immersed in a niiro-muriate solution of gold, and then plunged into a jar of hydrogen gas, it will become covered with a surface of gold hardly exceeding in thickness the 10,000,000th part of an inch. The gilt wire used in embroidery is formed by extending gold over a surface of silver.

The silk line, as spun by the worm, is about the 500th part of an inch thick; but a spider's line is, perhaps, six times finer, or only the 30,000th part of an inch in diameter: insomuch, that a single pound of this attenuated substance might be sufficient to encompass our globe.

Emery, after it has been ground, is thrown into a vat filled with water, and the fineness of the powder is distinguished by the time of its subsidence. In very dry situations, the dust lodged near the corners and crevices of ancient buildings is, by the continual agitation of the air, made to give a glossy polish to the interior side of the pillars and the less prominent parts of those venerable remains. So fine is the sand on the plains of Arabia, that it is carried sometimes 300 miles over the Mediterranean, by the sweeping sirocco. Along the shores of that sea, the rocks are covered by the pholas, a tastaceous and ebible worm, which, though very soft, yet, by unwearied perseverance, works a cylindrical hole into the heart of the hardest stone. The marble steps of the great churches in Italy are worn by the incessant crawling of abject devotees; nay, the hands and feet of bronze statues are, in the lapse of ages, wasted away by the ardent kisses of innumerable pilgrims that resort to those shrines. What an evanescent pellicle of the metal must be abraded at each successive contact! The solutions of certain saline bodies, and of other coloured substances, exhibit a prodigious subdivision and dissemination of matter. A single grain of the sulphate of copper, or blue vitriol, will communicate a fine azure tint to five gallons of water. In this case, the copper must be attenuated at least ten million times; yet each drop of the liquid may contain as many coloured particles, distinguishable by our unassisted vision. A still minuter portion of cochineal, dissolved in deliquiate potash, will strike a bright purple colour through an equal mass of water. Odours are capable of a much wider diffusion. A single grain of musk has been known to perfume a large room for the space of twenty years. Consider how often, during that time, the air of the apartment must have been renewed, and have become charged with fresh odour! At the lowest computation, the musk had been subdivided into 320 quadrillions of particles, each of them capable of affecting the alfactory organs. The vast diffusion of odorous effluvia may be conceived from the fact, that a lump of assafœtida, exposed to the open air, lost only a grain in seven weeks. Yet, since dogs hunt by the scent alone, the effluvia emitted from the several species of animals, and from different individuals of the same race, must be essentially distinct.

But the diffusion of the particles of light defies all powers of calculation. A small taper will illuminate the atmosphere to the distance of four miles; yet the luminous particles, which fill that wide concavity, cannot amount to the 5000th part of a grain, which may be the whole consumption of the wax in light, smoke, and ashes.

It is not, however, inanimate matter alone that is capable of such minute division. There are some organized beings thousands of which can be raised on the point of a pin! Such is stated to be the fact by many eminent microscopic observers, and after reading the previous instances of the minute subdivision of unorganized bodies, the one circumstance does not certainly appear more extraordinary than the other.

Digitized by Google

## MISCELLANIES.

*Greenwich Railway.*—A very stupid hoax was last week practised upon the public respecting this railway, by some stock-jobbers, we suppose, who wished to purchase shares. It was reported, that Mr. M'Intosh, who is a creditor of the company's, had seized the carriages, &c. on the train, turned off the men employed by the company, and, by virtue of a writ of execution, taken the management of the whole concern into his own hands. A more foolish statement could hardly have been made, and of course, very few sensible persons were deceived by it, before the solicitor of Mr. M'Intosh had written to the Newspapers, explaining that the whole was a fabrication. These silly jokes, however, very often occasion much mischief.

*Mr. Crosse's Experiments.*—Our readers will recollect that a Number or two back we inserted a paragraph from the newspapers, in which it was stated, that Mr. Crosse had formed some insects of a peculiar character by means of Galvinism. We intimated our disbelief of this story, and it has since been admitted to be incorrect. It appears, however, that some small living creatures did make their appearance; and the experiments, to which those of Mr. Crosse have given rise, have certainly produced results that could not have been anticipated. Dr. Faraday, when lecturing at the Royal Institution, a few days since, stated "that he had himself obtained an insect, or rather animalculae, by a continuous voltaic stream from silica of potass." He also exhibited some insects obtained from hard polished stone, and which, like those of Mr. Crosse, appear to have been restored to life after remaining in a dormant state for centuries, or thousands of years. The subject will now no doubt receive due attention from scientific men, and we may expect some extraordinary discoveries.

*Vegetable Substance in Arsenic.*—It has been generally supposed that arsenic was so strong a poison, that it would entirely destroy organic life. M. Gilgen Krantz, however, chief surgeon to the third regiment of Engineers in France, who has been very successful in his studies concerning aquatic cryptogamia, has discovered a vegetable substance of the genus Leptomitus, or Hygrocrocis, in a solution of arsenic. M. Dutrochet also observed one of the same genus in a phial of Goulard water. In both cases the plants floated in the liquid.

## INSTITUTIONS.

*London Institution.* Finsbury Circus.—Monday, March 6, C. C. Clark, esq., on the early British Poets, at seven o'clock.

*Aldersgate-street Institution*—Wednesday, March 8, at eight, T. J. Searle, esq., on the Drama.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, March 9, at half-past eight, Mr. Buckingham, M. P., on Oriental History.

*Eastern Athenæum*, Stepney Square.—Wednesday, March 8, N. F. Zaba, esq., on Polish Literature, at eight.

*Islington Literary and Scientific Society.*—Thursday, March 9, Mr. T. Cromwell, on the Archeology of the British Islands, at eight.

*Westminster Mechanics' Institution*, Grosvenor St., Millbank Row.—Wednesday, March 8, S. Logan, esq., on Phrenology, at eight.

*Kentish Town Mechanics' Institution.*—Monday, March 6, F. H. Showler, esq., on the Circulation of the Blood, at eight.

*Poplar Institution*, East India Road.—Tuesday, March 7, S. Logan, esq., on Phrenology, at eight.

### TO CORRESPONDENTS.

"T. W. Ritchie." We intend to give an engraving and description of the machine shortly, and have not therefore thought it necessary to insert his query.

The paper "on Accidents from Cleaning Windows improperly," we will find room for.

"W. C. C.'s" letter was overlooked, or we should have acknowledged the receipt of it. We are much obliged for the answer, but the letters that have already appeared are sufficient.

"Swolby." If we receive a satisfactory answer to his query we will insert it.

The "Answer to the Letter on the Results of Machinery," next week.

"Mr. Clements'" papers and illustrations in a Number or two.

The letter "on accidents from Fire and Shipwreck" has been received, and shall have our early attention.

"S." Hydrogen Gas although itself inflammable, will not support combustion. If a lighted candle be suddenly plunged into a vessel containing this gas, it will be immediately extinguished.

"Critic." The word should have been *think*; it was not a grammatical error, but the word was overlooked when read.

"The Report of the Quarterly Meeting of the London Mechanics' Institution" in our next.

"N. N." We are much obliged. He need not have made any apology for the composition of his letter, as we have invited, and shall always be happy to receive, communications from practical men on subjects calculated to improve their fellow-workmen or the public generally.

A monthly part is published, stitched in a wrapper, price *Fourpence*.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

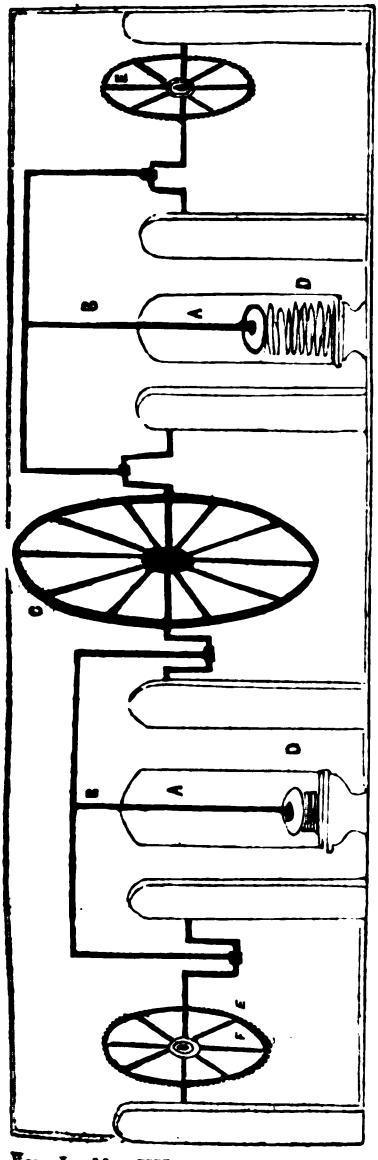
Digitized by Google

# THE PENNY MECHANIC.

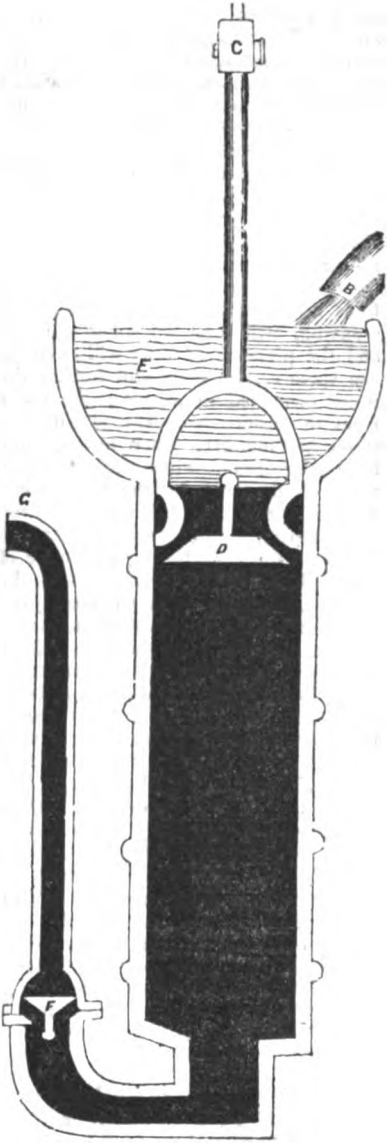
A MAGAZINE OF ARTS AND SCIENCES.

No. XX.] SATURDAY, MARCH 11, 1837. Vol. I.


PERPETUAL MOTION.




KING'S FORCE PUMP.







Holloway Press: D. A. Doudney.



Digitized by Google

## KING'S FORCE PUMP.

*To the Editor of the Penny Mechanic.*

SIR,—I send you herewith the drawing of a plan for a Force Pump I have invented, which may be of service to some of your numerous readers. It will be applicable to a beam engine where there are two pumps, viz. force, and lift, so for the lift, to supply the force pump; also for water-closets, &c. C is the piston or pump-rod, to which is affixed a bucket just the reverse to the lift pump with valve D. F is the valve which supports the column of water within pipe G. E is the water which is contained in a small cistern on the top of the pump, which is kept supplied from the pipe B. Now the water in the cistern will naturally rush down the pump and force up the valve F, and up the pipe G till it finds its level; the piston rod then descending, will force the valve D close, and the pressure of water will force up the valve F, and force still further the water contained in pipe G; the water from the cistern will descend with the piston and plunger, which having gone its regular distance will ascend, the valve F will drop to support the water forced up the pipe G, the valve D will drop down having no pressure underneath to support it up, also, having a pressure of water above what descended with the plunger, the water above will occupy the space of the water forced up until the plunger descend again, then it will force up the valve F, and will continue to do so as long as motion is given and the pump supplied with water from pipe B. I consider that this pump will not require so much power to work it as those now commonly in use, as the plunger descends the body of water contained in the cistern will naturally descend, also the weight of water bearing on the plunger will assist greatly in forcing the water up the pipe G, and where it may be required. If, Sir, you consider this worthy of your notice the insertion will oblige

Your Subscriber, &c.

JOHN KING.

## LAND SKATES.

*To the Editor of the Penny Mechanic.*

SIR,—An idea has suggested itself to me, that it is possible to propel yourself along a smooth and level plane, by means of an article which I would designate by the name of *Land Skates*, and the way that I propose is this:—

These land skates are to be made precisely in the same manner as other skates, with one exception, which is, that instead of having a piece of iron or steel running along the bottom of them, a single row of small brass or iron wheels is to be substituted, which might be half imbedded in the wood. These skates are to be buckled round the legs the same as any others, and it occurs to me that you might keep yourself in motion with them on a smooth surface, in the same manner that you would were you upon ice. Whether I am right, or wrong, remains for me to be told, either by yourself, or your kind correspondents.

I am, Sir,
Your most Humble Servant.
H. BAKER.

## IMPROVED CONDITION OF THE WORKING CLASSES.

SECOND ARTICLE.

WITH respect to wages, if any unemployed person refused to serve at the wages fixed by the statute of 1496, he might be imprisoned till he found sureties to serve according to the statute. The latter part of this statute regulates the hours of work and meals, by providing that the hours of labour, from March to September, shall be from five o'clock in the morning, till seven in the evening; that one hour shall be allowed to breakfast, an hour and half for dinner, and half an hour for *noon-meate:* the hours of labour in winter are from "springing of day" to dark, and only one hour is allowed for dinner, the extra half-hour at the meal being only allowed for sleeping, from the middle of May to the middle of August.

By such acts of tyranny as these it may be imagined the condition of the people was much depressed; even so late as the reign of Queen Mary, the dwelling of an English peasant was little superior in comfort and cleanliness to what we observe in the clay-built hovels of the Irish. The dwellings of the common people, according to Erasmus, had not yet attained

Digitized by Google

the convenience of a chimney to let out the smoke, and the flooring of their huts was nothing but the bare ground: their beds consisted of straw, among which was an ancient accumulation of filth and refuse, with a hard block of wood for a pillow. And such in general was the situation of the labouring classes throughout Europe. Fortescue, who wrote in the reign of Henry VI., speaking of the French peasantry, says, "Thay drink water, thay eate apples, with bread right brown, made of rye; thay eate no fleshe, but, if it be selden; a littell larde, or of the entrails or heds of beasts, sclayne for the nobles or merchaunts of the lond."

Coming down to a later period, we find the relation between wages and price of food, the best criterion of the condition of the working classes. Hume remarks, in his History of England, that he had not been able, by any inquiry, to learn the common price of butcher's meat during the reign of James the First. Mr. Birch, however, in his "Life of Prince Henry," published in 1760, states the prices paid for flesh, by the purveyor of the prince's household, about the beginning of the seventeenth century, from which it appears that the price of beef was about 3½*d.*, and of mutton about 3⅝*d.* per pound. At the same time, wheat was 30*s.* the quarter, butter 6*d.* and loaf-sugar 1*s.* per pound; while the highest wages of agricultural labourers were 10*d.* per day, without food, the majority being paid only 6*d.* to 8*d.*, and women earning no more than 5*d.* per day. The daily wages of artificers varied at this time, according to their skill, from 8*d.* to 1*s.*; a master carpenter alone, who directed the labours of others, obtained as much as 1*s.* 2*d.* Under these circumstances, it is clear that the industrious classes were but little able to command the use of those articles of consumption which now form so large a portion of their constant food. Wheaten bread was, in those days, a luxury confined to the use of the nobility and gentry. Even the household servants, in great families, were not provided with such delicate food, but were forced to content themselves with rye bread and oatmeal. Potatoes, now so extremely common, were then scarcely known, and cost 2*s.* the pound, being provided, as a great delicacy, for the table of his majesty. Even so late as 1725, but little more than a century since, the wages of labour had made little or no advance upon the rates just mentioned. The best husbandry labourers in the county of Lancaster were limited, in that year, by the justices of the peace in quarter-sessions, to 1*s.* per day, and "the ordinary sort" of such labourers received only 10*d.* without meat and drink; where food was supplied by the employer, only half these rates were paid. Women employed in haymaking received 7*d.* per day, without food, and only 3*d.* with it. Masons, carpenters, and the like kind of artificers, were limited to the daily pay of 1*s.*, and had no more than 6*d.* when meat and drink were allowed. The master workman, who had others serving under him, had 2*d.* added to this rate. A master tailor had no more, however, for his daily wages, than 1*s.* without food, and his journeymen were paid only 10*d.* At this time the prices of provision appear to have been very nearly the same as they were a century before; and during all that time the condition of agricultural labourers and artificers, in the distant parts of the kingdom, must have continued very stationary. A marked improvement in their situation appears, in the meanwhile, to have been secured by them in or near the metropolis. From the tables, kept at the Royal Hospital, Greenwich, of the contract prices of provisions and clothing purchased for the use of that establishment, as well as of the daily wages paid to such artificers as were employed therein, we learn that, in 1730, the price of meat was 2¾. per pound; that the cost of wheaten bread was equal to 6⅛*d.* for the four-pound loaf; that butter was 4½*d.* and cheese 3⅛*d* per pound; oatmeal 4*s.* 6*d.* per bushel; candles were 6½*d.* per pound; shoes 4*s.* per pair; coals 28*s.* 5*d.* per chaldron; stockings 1*s.* 9*d.* per pair; and hats 2*s.* 8*d.* each. At this time, carpenters, bricklayers, and masons, were paid each half-a-crown per day; joiners had 2*d.* additional, and plumbers received 3*s.* It must be borne in mind that the prices here given are those for which

Digitized by Google

a great establishment was able to purchase large quantities of each description of food and clothing, and that the retail prices, especially to persons whose limited means obliged them to buy only small quantities, would be considerably dearer.

After comparing these times with the present, we say with a late writer, who will deny that the labouring artizan of the present day, in England, finds within his reach more and greater comforts than were enjoyed by the most powerful lords in feudal times? The products of the Indies are to be found on his table; the materials of which his cheap and comfortable dress is made come in a great part from places, the very existence of which was unknown to our ancestors; and by the inventions of ingenious men, the prices of manufactured goods have been so materially reduced, while their qualities have been so importantly improved, that scarcely any persons are so destitute as to be unable to provide themselves with decent and appropriate clothing. The cottages of our working artizans are, most of them, provided with articles of furniture which, although now so common that the want of them would be considered a hardship, were wholly unknown in the days of Elizabeth; and we have long since ceased to apprehend,—at least in this part of the kingdom,—a recurrence of those dearths which, in former times, brought misery and disease in their train, to a degree and with a frequency which thinned the ranks of the industrious classes, and impeded the progress of the community at large. This improvement, which is rendered glaringly apparent by thus contrasting distant periods, has not been brought about by any sudden or accidental causes, but has been steadily progressive. It would not be very difficult, however, to show that its progress has been more rapid during the last century than in any preceding equal number of years; and that, of this period, the twenty years just elapsed, during which Europe has been blessed with peace, have witnessed, in this country, the most rapid strides towards a general amelioration in the condition of all classes of the community.

## ADVANTAGES OF MACHINERY.

THERE exists, perhaps, no single circumstance which distinguishes our country more remarkably from all others, than the vast extent and perfection to which we have carried the contrivance of tools and machines for forming those conveniences of which so large a quantity is consumed by almost every class of the community. The amount of patient thought, of repeated experiment, of happy exertion of genius, by which our manufactures have been created and carried to their present excellence, is scarcely to be imagined. If we look around the rooms we inhabit, or through those storehouses of every convenience, of every thing that man can desire, which deck the crowded streets of our larger cities, we shall find in the history of each article, of every fabric, a series of failures which have gradually led the way to excellence; and we shall notice, in the art of making even the most insignificant of them, processes calculated to excite our admiration by their simplicity, or to rivet our attention by their unlooked-for results.

The accumulation of skill and science which has been directed to diminish the difficulty of producing manufactured goods, has not been beneficial to that country alone in which it is concentrated; distant kingdoms have participated in its advantages. The luxurious natives of the East, and the ruder inhabitants of the African desert, are alike indebted to our looms. The produce of our factories has preceded even our most enterprising travellers. The cotton of India is conveyed by British ships round half our planet, to be woven by British skill in the factories of Lancashire: it is again set in motion by British capital; and, transported to the very plains whereon it grew, is repurchased by the lords of the soil which gave it birth, at a cheaper price than that at which their coarser machinery enables them to manufacture it themselves.—*Babbage.*

## PATENT LAW.

AN Act has been passed in the Session of Parliament 1835, to do away with some of the defects with which our antiquated Patent Laws are encumbered; and although it does not pretend to an entire removal of the causes of complaint, yet considering the admitted difficulties of the case, and the very objectionable nature of some of the former propositions for amendment, we are not sorry that the work of improvement has been begun

Digitized by Google

with caution; at the same time we wish to consider what has been done only as a beginning, and hope it will lead the way to a general amelioration.

One great grievance of the system, was the destruction of all right to a patent which resulted from an inadvertent claim put in to any part of an invention which might not actually be new, although that circumstance should be unknown to the inventor, and even although the part claimed should be a small and unessential portion of the whole invention. To make this matter clear, it must be stated that, in explaining the nature of an invention, such as a machine for instance, the patentee is compelled to describe the construction of his invention in the fullest detail, so as to enable an ordinary workman to construct a similar machine. As in every such new invention, certain parts must almost necessarily be well known, certain wheels and levers will be like wheels and levers in other machines; and as to these wheels and levers the patentee can have no exclusive right, he is expected to declare in his specification what parts of the machine he claims as his own invention. To these alone he has exclusive right; all other parts are public property, and may be used by any one. Thus far all is right; if it were otherwise, a patentee might be allowed a right to what is not his own. The grievance complained of is, that if a patentee should inadvertently lay claim to any part of his new invention, which part might afterwards be found not original, he lost not only his right to an exclusive use of that one part, but to the entire invention, however new it might be. He was thus cooped up in a dilemma; if he did not claim the whole of his invention, from a fear of overclaiming, he of course lost his right to that which he did not claim: if, on the contrary, he claimed all which was his own, and it should be found that some part was not original, then he lost his whole patent. The motive to this severity seems to have been the wish to prevent by a penalty an unprincipled schemer from endeavouring to appropriate to himself more than his own. But while the schemer was punished, the honest inventor was often a sufferer. A new machine might have great merit, it might in principle and action be perfectly new; but some of its details might have been used in some other machine now in disuse, quite unknown to the inventor. This is discovered by some rival manufacturer, and the patentee loses his right. By the act now passed, this grievance is done away with; if a patentee should be in the situation supposed, if he should find that some portion of his invention has been anticipated, he may now, on a proper representation, obtain leave to enter and enrol a disclaimer of such portion, and remain in the situation he would have been in, had no such claim ever been put forward.

It has been objected to this alteration, that advantage may be taken of it by a dishonest schemer, who may take out a patent for an invention not his own, and then, as he finds himself discovered, enter a disclaimer, first to one part and then to another, as such parts are objected to, and in the mean time reap all the advantage of his patent, as though the invention were his own. This we imagine is an impossible occurrence; it must be remembered that the enrolment of the disclaimer is not a matter of right, that it may be refused by the Attorney-General, unless a sufficient cause is alleged for the alteration, and that in case of fraud it would undoubtedly be refused. There is also another check, and a strong one, against such a practice: the disclaimer cannot be received in evidence, in case of an action brought before such disclaimer was enrolled. A patentee, therefore, who should make an overclaim, and against whom an action should be brought in consequence of that overclaim, will, as far as that action goes, stand precisely in the situation he would have stood in before the new act was passed. He will be liable to the same penalties, and be put to the same expense in the suit. The only difference is, that he will be enabled to protect himself from the loss of his whole patent in such a case, and will stand upon his own right in future. Now an honest patentee will, it is true, suffer in the immediate action the penalty of his inadvertence, but no more. The dishonest one will render himself liable to the same penalty, as often as he shall attempt to make use of any right given him by a fraudulent claim.

The second clause enacts, that if a patentee shall have reproduced some old

Digitized by Google

invention, believing himself to be the inventor, it shall be in the power of the crown, upon a recommendation of the Judicial Committee of the Privy Council, to continue the patent to the patentee, wherever it shall appear that the invention has not been publicly and generally used. It is feared by some persons that all kinds of old inventions will be brought up again and promulgated as new, under favour of this clause, and that every body will be taking out patents for old and abandoned projects. This appears very absurd. To say nothing of the expense of taking out patents, and the almost certainty of their being useless to the patentee (for we may be well assured that in ninety-nine cases out of a hundred the inventions would not have been abandoned if they had not been useless), there are so many checks against the continuance of such patent by the crown to any but a *bonâ fide* re-inventor, that few persons will feel inclined to rake out old books for the purpose of picking up lost inventions. If any person should be lucky enough to re-produce an invention of value abandoned from any cause, and generally forgotten, we see no harm in his having the monopoly of its use for a few years as a recompense for his bringing to light a valuable idea, though we would rather he should be entitled to it without any misrepresentation.

The third clause contains a provision against the repeated vexatious actions by which a patentee might be put to enormous law expenses under the former act. Before the passing of the new law, although an action respecting the validity of a patent might be decided in favour of the holder of the patent, this verdict was no bar to a future action, nor to any number of future actions. Although nothing new could be alleged, although it was but going over the same ground again and again, the patentee might be compelled year after year to defend himself against fresh actions, to his great injury, perhaps to his ruin. The clause enacts, that in any action respecting the validity of a patent, if a verdict pass in favour of a patentee, the certificate of the judge who tried the action may be adduced in evidence on any future action; and if the verdict in such subsequent action be given in favour of the patentee, he shall receive treble costs.

By the fourth clause, an extension of the term of a patent, not exceeding seven years, may be granted by his Majesty, on a recommendation of the Judicial Committee of the Privy Council, who may call and examine witnesses in the case of a petition for extension. This is decidedly an improvement: the term of fourteen years granted indiscriminately by every patent, is too short in some cases to render any profit to an inventor, and this chiefly in those inventions of great value which require time to introduce. We may instance Watt's improvements on the steam-engine, which from prejudice and other causes were hardly in general use when the term granted by his patent expired. By the old act, no extension could be obtained without an application to Parliament, which has attended with so many difficulties that it has been rarely resorted to.

The fifth and sixth clauses refer to the manner of conducting trials for infringement of patent rights, and regulate the costs in such actions. The last clause inflicts a penalty upon any person putting the name or mark of a patentee upon any article without his permission.—*Companion to Almanack*, 1836.

In No. XII. of the Penny Mechanic, we have given an abstract of the act.

The expense of taking out a patent has often been loudly complained of. Several correspondents have written to us requesting to be informed the exact expense; this it is not possible to give, since it varies for different patents. When a select committee of the House of Commons sat in 1829, it appeared from the evidence of witnesses examined before it, that the expense of taking out a patent for England amounts to about 107*l.*; for Scotland about 80*l.*; and for Ireland about 128*l.* It will be considerably greater, however, in each case, should any opposition be made. To these sums must also be added the expense of the specification, which is generally drawn up by a professional adviser, and costs more or less, according to its length. "I have had them," says Mr. Farey, the engineer, "as high as 200*l.* for one very intricate invention, where there were patents for all three kingdoms; and from

Digitized by Google

that to as low as three guineas." The average charge he reckons as amounting to about 20*l*. Another witness, Mr. Moses Poole, one of the clerks in the Patent Office, mentions 960*l*. as about the whole expense of taking out patents for the three kingdoms, "if with a short specification, and no opposition." A third, Mr. Samuel Morton, who had been connected with his brother in taking out a patent for a slip invented by the latter for hauling ships out of the water, states that the three patents for England, Scotland, and Ireland, including agency, cost about 450*l*.

### PERPETUAL MOTION.

*To the Editor of the Penny Mechanic.*

SIR,—I sometime ago sent you a diagram of a steam boiler, which I saw answered in your valuable Magazine, that it should be attended to, which I thank you for, I now wait upon you with an article of quite a different nature. This is a diagram of a perpetual motion; I hope you will find a place for it in your magazine, and at the same time, that it will meet with your readers approbation. The machine represented in the first page will require but little trouble: it will only be necessary to keep the works clean, indeed, all kinds of machinery require this, for there is nothing like cleanliness in any thing. Although the machine is not so powerful as one moved by steam, nor do I say it would supply the use of steam, yet for little power it might be useful, or perhaps only for curiosity; or for raising water; or for a grocer in turning a mill; in this case it really might be useful. I am not one of those who descant too much upon the properties of their articles, but say what is fair in stating what it might be useful for. It is simple enough in its construction. The first cause of its motion is the spring D in the tube A, which acts against the piston B, which sets in motion the fly wheel C. On the otherside are also the same works; when the spring D is at its full extent on the right side, it is down on the left, as seen in the diagram, therefore always keeping one spring down, as when rising to force the wheel C round, while it forces the other spring down, so that while one spring is rising, the other is falling, and keeping up a constant succession; which, if only one spring, would be likely to stop itself when the spring was at its full extent; or, indeed, if both springs acted at once the consequence would be that double the strength would be then added, and it would be still more likely to check itself; but this is rectified by one rising, and the other falling, which keeps up the perpetual motion, and turning the wheel E, which is toothed, so as to act upon any other machinery, indeed it would work two machines at once by adding the wheel F E.

Your most Obedient Servant,
J. W. RITCHIE, JUNIOR.

## MISCELLANIES.

*British Museum.*—Our readers will no doubt be gratified to learn that in future the British Museum will be open to the public during the whole of the Easter, Whitsun, and Christmas holiday weeks, except Saturdays. The injustice of preventing the working classes having admission to the National Museum, during the only time when they could do so without inconvenience to themselves, was only equalled by the absurdity of expecting by this impolitic measure, to prevent injury being done to the curiosities preserved in the museum; for it is evident that if persons were inclined to be mischevious, they could gratify their propensity at other times, when there would be no restriction with respect to who should be admitted. For all that is said about the mischievious disposition of the English people, and their propensity to disfigure and injure works of art, it is a fact deserving notice, that while the managers of the British Museum have never had to complain of improper conduct of this kind, although there is no charge for admission, yet the Literary Gazette a short time since uttered a furious anathema against certain persons, who it seems have nearly carried away the "mast of the Victory," (Lord Nelson's ship) in Windsor Castle, by breaking off small pieces as "tokens," and these persons had to *pay* highly for the gratification of their curiosity. We do sincerly hope that the trustees of the British Museum will not stop in their reforms; but that before long the reading rooms will be opened to the public in *the Evening*.

*Gas Reflectors.*—Most of the Gas-lights in respectable shops, particularly those of stationers and linen-drapers, have a tin reflector placed round the glass of the gas-burner, for the purpose of throwing the light on the goods in the window beneath. This is a great improvement, but if the tin reflectors were made *concave* instead of flat, the light would be much more powerful than it is at present. More of it would be reflected downwards.

Digitized by Google

*Preservation of Iron from Rust.*—A mastic or covering for this purpose, proposed by M. Zeni, and sanctioned by the Societé d'Encouragement, is as follows: eighty parts of pounded brick, passed through a silk sieve, are mixed with twenty parts of litharge: the whole is then rubbed up by the muller with linseed oil, so as to form a thick paint, which may be diluted with spirits of turpentine. Before it is applied the iron should be well cleaned. From an experience of two years, upon locks exposed to the air, and watered daily with salt water, after being covered with two coats of this mastic, the good effects of it have been thoroughly proved.

*Purifying Dwellings.*—The following is Dr. J. C. Smith's recipe for purifying houses where contagion is supposed to exist, for the discovery of which that gentleman received a parliamentary grant of 500*l.*—Take six dr. of powdered nitre, six dr. of oil of vitriol, mix them in a tea-cup, by adding to the nitre 1 dr. of the vitriol at a time; the cup to be placed, during the preparation, on a hot hearth or plate of heated iron, and the mixture stirred with a tobacco-pipe or glass rod; the cup to be placed in different parts of the contaminated chamber.

*State of the Atmosphere in London.*—It is reported in the *Journal des Connaissances Usuelles et Practiques*, that M. Darcet, while in England, having discovered effects in London, with reference to the buildings, which he considered could only be produced by sulphuric acid in the atmospheric air, he attached to his hat every morning, before going out, a piece of paper, made blue by turnsol, which was very soon changed to red; whilst similar pieces, that were exposed only for a few moments to the influence of the air, became studded by a great number of small red points. During the whole of his stay in London, M. Darcet renewed his experiments every day, which were attended with the same result, and he carried with him to Paris, on his return, a great number of the small pieces alluded to. The sulphuric acid is attributed to the coal.—*Repertory of Patent Inventions.*

## INSTITUTIONS.

*The Meteorological Society* will hold its Anniversary Meeting on Tuesday, 14th instant, at eight P.M.

*London Institution*, Finsbury Circus.—Monday, March 13, at seven, C. C. Clark, esq., on early British Poetry.—Thursday, March 16, H. J. Gauntlett, esq., on Music.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, March 15, Mr. Cowper, on Weaving.—Friday, 17, Mr. Wood, on Perspective. Both at half-past eight.

*Aldersgate-street Institution*—Wednesday, March 15, at eight, T. J. Searle, esq., on the Drama.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, March 16, at half-past eight, Mr. Buckingham, M.P., on Oriental History.

*Eastern Athenæum*, Stepney Square.—Wednesday, March 15, at eight, N. F. Zaba, esq., on Polish Literature.

*Islington Literary and Scientific Society.*—Thursday, March 16, at eight, Mr. Downes, on the Archeology of the British Islands.

*Poplar Institution*, East India Road.—Tuesday, March 14, at eight, B. R. Haydon, esq., on Painting.

*Society of Arts*, Adelphi.—Tuesday, March 14, at eight, J. Taylor, esq., on Mining.

*Westminster Mechanics' Institution*, Grosvenor St., Millbank Row. — Wednesday, March 15, at eight, R. F. Showler, esq., on the Circulation of the Blood.

*Kentish Town Mechanics' Institution.*—Monday, March 14, J. Smith, esq., on the Essentials of General Happiness.

*Bermondsey Mutual Instruction Society.*—Monday, March 13, at eight, Mr. L. Rickard, on the Steam Engine.

## TO CORRESPONDENTS.

We have not received either of the three circulars of the "Tower-street Society," or the notices should have been inserted. There must be some mistake, we think.

"J. C. P." has our thanks for his communication. The invention, although ingenious, having, however, previously appeared in a similar publication, prevents our making use of his letter.

"W. Clements" received. It shall be attended to.

"N. N." Coal gas is carburetted hydrogen.

We are sorry to be obliged to postpone the letter on the "Results of Machinery," but it takes up more room than we can possibly spare this week.

"Query." Any Encyclopædia will afford our Correspondent the information he requires. We cannot spare room, or we should be happy to answer his question at length.

"S. S." We have many times received letters similar to that of our Correspondent; and several of the papers have also suggested our increasing the size and price of THE PENNY MECHANIC. The subject, however, requires consideration. Although there would be advantages attending an increased size, there would also be some disadvantages.

The Monthly Part of THE PENNY MECHANIC is published at Four-pence. The Cover and Index is not charged for.

All communications intended for the Editor should be addressed to *him*, and not to the *Publisher*. Some of our Correspondents have made a mistake in directing to the latter Gentleman.

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

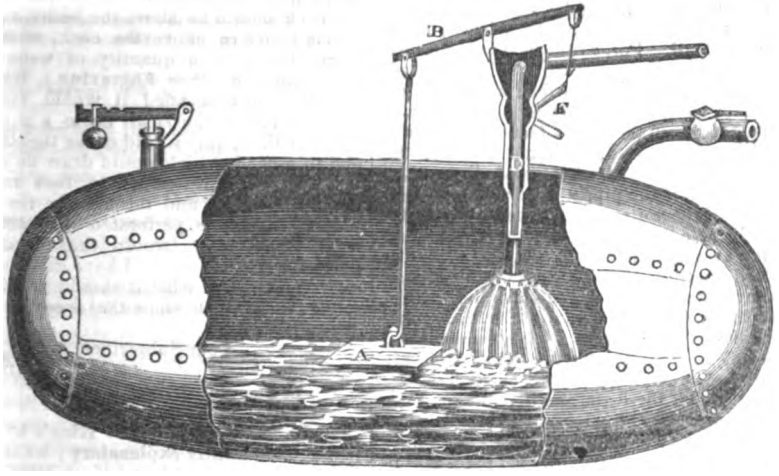
Digitized by Google

# THE PENNY MECHANIC.

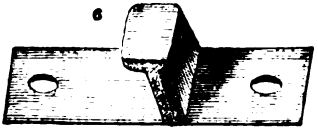
A MAGAZINE OF ARTS AND SCIENCES.

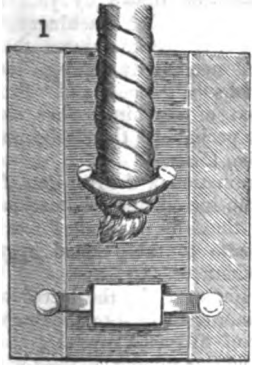
No. XXI.] SATURDAY, MARCH 18, 1837. Vol. I.

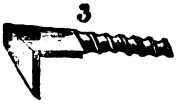
## KING'S STEAM BOILER.

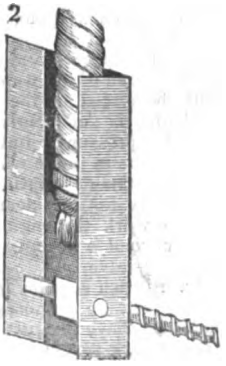



## NEW PLAN FOR HANGING WINDOW-SASHES.








Holloway Press: D. A. Doudney.

Digitized by Google

## THE STEAM BOILER.

*To the Editor of the Penny Mechanic.*

SIR,—In reference to my remarks on Mr. Douglas's Steam Boiler, your reader, Mr. J. F. Puttich, in No. 16, states, that he thinks my "arrangement of the water valve will not tend to ameliorate the bad qualities of Mr. Douglas's invention, in so great a degree as could be wished, if indeed at all. For, as the heat is continued and the expansive force of steam increased, it will press on the surface of the water, which having no other way of escape, will be forced up the pipe F (see "Penny Mechanic," fig. 1, p. 65), and produce the same effects as Mr. King stated would be the result if the pipe F were above the surface of the water, viz., force up the water valve, &c." Mr. J. F. Puttich thinks that my arrangement would not ameliorate the bad qualities of Mr. Douglas's invention; now I not only think, but have the greatest confidence it would, for, as Mr. Douglas's boiler is supplied by a pipe connected at one end on a level with the bottom, my mode is for a pipe to descend below the surface of the water, so that the pressure of steam shall be according to the diameter of the pipe; and the water continually descending the pipe will cool the water in a great measure within the pipe, so that there will be scarcely any pressure of steam rising within it. Mr. Puttich says, "that the steam having no other way to escape will be forced up the pipe F;" what, then, would Mr. Puttich shut the communication to the cylinder, and would he do away with the safety valve? or would he tie or otherwise load the safety valve, so that it would be beyond the power of steam to force it up? If Mr. Puttich intends doing this, I coincide with him, that having no other way to escape, the steam would naturally press on the surface of the water, and the water would be forced up the pipe F, provided the boiler is sufficiently strong to sustain the pressure; but I leave it to your readers to judge what manner of use a boiler of this description would be, having no way for the steam to escape, not even to work the engine, or to escape when beyond a certain pressure, out of the safety-valve.

Mr. Puttich goes on to remark, that to remedy this, he proposes that the pipe F should be above the surface of the water, having a cock connected with the pipe, as seen in No. XVI., p. 124. I consider this would not answer the intentions of Mr. Puttich, as the cocks are made of brass; and as that metal is a great conductor and retainer of heat, the cock would consequently be exposed to the full action of the steam, which would be a very great heat. Now the cock, being greatly heated, would naturally expand, and cause it to go stiff, and perhaps make it set fast; which, if it did so, would prove very dangerous. To remedy this evil of Mr. Puttich's improvement, I would propose that the cock should be above the boiler, with a small cistern above the cock, so that there should be a quantity of water to keep this cool. (See Engraving.) When the float A descended it would cause the float end of the small beam B to descend with it; this would cause the other end to ascend, which would draw up the handle F; the water would then rush down the pipe D, and through the rim at bottom, which is perforated with small holes. The water would thus be dispersed similar to rain. I have drawn the water lower than what it should be with safety, in order to show the operation of my improvement.

Your Subscriber, &c.

JOHN KING.

*No. 8, Lucretia-street, Lambeth-walk.*

*** The latter part of Mr. King's letter was not sufficiently explanatory; we have therefore taken the liberty of omitting it. ED. P. M.

## RESULTS OF MACHINERY.

*To the Editor of the* PENNY MECHANIC.

SIR,—Observing in No. XVIII. of your useful publication, a Letter to the Editor, headed "Results of Machinery," I beg to intrude upon your attention in reply to the conclusion drawn by your Correspondent; viz., that machinery, "by performing his work, injures the labourer, and necessarily deprives him of his means of subsistence," and "that the introduction of machinery has always been more prejudicial than otherwise to the *Working Classes*."

An examination of the real state of the case, on the introduction of machinery, will show that the "results" are the very opposite to those stated by your Correspondent.

A manufacturer, by the introduction of a machine, is enabled to dispense with the labour of fifty of his workmen, and thereby save the amount of their wages, say 3000*l.* per annum. How does the capitalist employ the money saved? Does he throw it into the sea, or bury it in the earth? No; he employs it again in

Digitized by Google

his particular trade, and thereby swells his income. Or he increases the comforts and luxuries of his home. In which ever way he uses the capital saved by the machine, whether in enlarging his factory, or by building a new one, or by increasing his stock in trade, or by purchasing superior furniture for his house, or setting up a carriage; no matter in what way he employs the capital saved; he employs as much labour as formerly; or, what is the same thing, he purchases the fruits of capital and labour combined. He pays for commodities, formerly manufactured or obtained by human labour; because such a recompense was expected; such a return was looked for in the ordinary course of trading operations. So that the 3000*l.* saved by the machine, employs or pays for as much human labour as before, and consequently the aggregate demand for labour in the market is as great as it was previous to the introduction of the machine; always excepting that portion of the saving which the manufacturer, from some peculiar whim or fancy of his own, chooses to throw into the sea, or bury under the earth.

There is another mode deserving of notice, in which the money saved may probably be used. It may be placed in a banker's hands, or in the funds. The banker receives the money for the purpose of using it in his business. He would not be at the trouble and risk of receiving it unless he could use it profitably. The discounts, the additional accommodation he is thus enabled to afford manufacturers, merchants, farmers, &c., enables them to employ more labour. As to placing money in the funds, that may be said to be nothing more than a transfer of means from one who wishes to keep his money idle, to another who wishes to employ it actively.

It is true that the consumption of some individuals and of some classes is less beneficial than that of others. But in the present case the probabilities on the whole are equal. The sum of 3000*l.* is as likely to be employed beneficially in the hands of A as of B. Therefore, on these considerations, I contend I am justified in coming to the conclusion, that the introduction of a machine, attended with a saving to the manufacturer, and dismissal of some of his labourers, does not, *in the aggregate*, supersede human labour; does not diminish the demand for labour, or the amount of wages.

Let us extend this case to the whole trade, and view it in another light, by tracing the further effects of the introduction of machinery.

We will suppose that the commodity, whatever it may be, has been doubled in quantity, and reduced one-half in price. We will suppose the consumers to have paid two millions of pounds annually for the article or articles. Now they have to pay only one-half; having, of course, one million in their possession, to be disposed of in whatever way they think most conducive to their welfare. That this is a benefit to the consumer; that it is an increase of the national wealth, will not be denied; therefore the only question is, how does it affect the working classes as a body? They, of course, partake of the benefits in their character as consumers; and this is a most important consideration. As workmen, there is an additional demand created for their labour to the amount of the capital let loose, which must and will be employed, and can only be employed in paying for labour in some shape or other. It is capital that employs human labour. It is the relative amount of capital and labour in the market that determines the high or low rate of wages. Here, then, "is the one thing needful" for the working classes; an increase of capital, which must necessarily be followed by a higher rate of wages, and consequent increase of their means of subsistence—of their comforts aud independence.

When we consider the vast increase of machinery, the multiplication of cases similar to that which I have endeavoured to illustrate, since the first invention of Arkwright, we cease to wonder at the almost magical alterations that have taken place within a short space of time. Not many years ago Liverpool was a fishing town, and Manchester a country village. Silk was formerly sold for its weight in gold; and cotton could be purchased by the rich only. Now the wife or daughter of a mechanic is better provided with cotton than a lady was a hundred years ago. Rye, and other inferior breads, are now almost universally forsaken for wheaten bread. The cotton

Digitized by Google

manufactures employed in 1760 about 50,000 persons; now the same manufacture employs about one million and a half. The number of cattle has kept pace with the relative increase of the inhabitants, while the weight has doubled.

The whole of your Correspondent's objections against machinery seem to me to be concentred in two propositions.

1st. The introduction of machinery into a trade injures the workmen in that trade.

2nd. There are low wages, and consequently misery and poverty among the working classes.

And from these two propositions, separately or conjointly, he infers that "machinery is more prejudicial than otherwise to the labouring classes."

With regard to the first proposition, no one ever denied that the introduction of machinery injured individuals,—injured particular trades; but until the facts and arguments stated above are clearly and satisfactorily replied to, I must still remain of the opinion founded, as I conceive, upon the most conclusive statements and reasoning; that this partial evil is attended with "universal good;" and that, to the working classes, in the aggregate, most particularly.

As to the second proposition, that misery and poverty exist among the working classes,—call upon the enemies of machinery to prove that low wages exist *because of*,—and not in spite of—machinery. Compare the number of hand-loom weavers and others, who have been injured, with those who have been benefited by machinery; and the injured will be seen to be exceptions to the rule, composing a small portion only of the whole body of the working classes. What would be the condition of England now, with the amount of her population doubled, were the quantity of machinery reduced to what it was seventy years ago? The condition of Ireland, without machinery, without manufacture, comparatively speaking, is an answer to the question. A considerable portion of the population would be without labour, without wages; subsisting by the charity of their fellow-countrymen, and that on the worst description of food which can keep soul and body together. While the other more fortunate portion of the working classes would be obtaining, as the highest rate of wages, six or seven shillings a week, instead of that being as now—in consequence of machinery—the lowest rate of wages.

I have intruded at too great length already upon your columns, but I cannot lay down my pen without expressing a feeling, which, though it does not bear directly on the question, is yet intimately connected with it; viz., that it is the bounden duty of the legislature not only to alleviate, but to remove, the evils suffered by any portion of the community, for the sake of the public and general benefit.

I am, Sir, your obedient servant,
J. B.

## TO PRESERVE PROPERTY FROM FIRE.

*To the Editor of the Penny Mechanic.*

THE simplest mode by which we can demonstrate the practicability of saving valuable property from fire will prove the most instructive, and bear with it a convincing proof that a right application of useful common inventions will often supply the place of more costly apparatus; and, in effect, prove safer and more desirable.

Take, for instance, a well-soldered tin, in any shape, say one foot square; at the distance of half an inch from the bottom, inside, place a few small bars, or strong wires, parallel to the bottom. Next, have another tin, nine inches square, with as large a circle in the top as possible. Let that part which is joined to the top be a female screw, and let the top screw into it. Having placed your valuable property in the small case, and secured the cover, place it inside the large case. Next, if you fill the large case with water, and let the water overflow the smaller case, is it not evident that the only effect a powerful fire will have on these cases is that of making the water boil, without, in the slightest degree, injuring the internal case and its contents; but, if the contents of the inner case were placed in an iron safe, the safe would get red hot, and its contents would be consumed.

On the principle described (which I believe is new) all combustible materials, spirits of wine, of turpentine, and even gunpowder, can be secured

Digitized by Google

against fire. Should the contents of any cask or case be likely to generate steam, and burst the cask, this effect can be guarded against by having small syphon-like pipes, rising a few inches higher than the water which surrounds the internal cask; and the steam generated will, if considerable, help to extinguish the fire.

On this principle, buildings that are sustained by cast-iron pillars may be constantly supplied with water, that, in case of large fires, will generate steam, which probably will assist in keeping the fire under. But to a certainty, the quantity of water contained in the pillars can be instantly got at, and the water will preserve the pillars from the effects of the fire. Under good regulations, in nine cases out of ten, the fires will be extinguished before the nearest engines arrive.

To preserve gunpowder under water, and thus prevent the dreadful evils that result from its explosion, as lately was the case in Limerick, is also a task easy to be performed. Let the powder be secured in tin cases, or small casks, either in cartridges or loose; let one end of the case or cask have a circular opening in it, and let the inside of this circle be a female screw. Let the top that is to fit in it be a male screw, that will not admit the water. When the top will be screwed home, by placing a weight on the case or cask it can be kept under water in perfect safety. This method is applicable to all powder manufactories, to all magazines and warehouses.

Should it be difficult at any time to prevent the leakage of the tin cases or casks that contain powder, &c., a coat of the solution of Indian rubber can be laid on, over the outside of the cask or case, and this will preserve the whole uninjured even for years.

In like manner, tea, sugar, ships' bread, and all manner of ships stores, together with the general cargoes of ships, can be secured against salt water.

M. Rough.

## WINDOW CLEANING ACCIDENTS.

If there are any accidents that deserve to be particularly designated by a name, they are those occasioned by the dangerous practice of suffering servants (generally female) to clean the outsides of the windows of gentlemen's houses. Notwithstanding the many dreadful accidents that this practice has occasioned, and the number of lives that have been lost from persisting in it, there appears to be very little desire to remedy the evil. After a housemaid has been impailed upon the railings, in front of a house, in consequence of having fallen out of a window she was cleaning, two or three stories high, we do not, perhaps, see servants, in the same street, exposing themselves to a similar danger for some short time; but after a while the accident is forgotten, and things go on much the same as usual. This is the necessary consequence of the present inconvenient way in which the windows of houses are constructed, and of the parsimony of the master or mistress of the house, who will not afford the money to pay a glazier for cleaning the windows in a proper manner.

The best remedy for this would undoubtedly be the construction of windows in a different mode to the present. A *Correspondent* (J. W. Ritchie) who has written to us on the subject, suggests that windows, instead of being made to open upwards, might slide into recesses formed on the two sides of the window-frame; the window being in two portions, similar to those which open on the lawn in gentlemen's country houses, only not hanging on hinges. Mr. Ritchie thinks this plan preferable to having the windows on hinges, which, indeed, would not at all remedy the evil complained of. But if one half of the window could be brought into the middle of the frame, while the other half remained in the recess, a person could get at the window from either the right or left hand of it, and the window could then easily be cleaned.

The following description of a contrivance for expeditiously detaching the lines of window-sashes is, however perhaps better calculated to answer the end in view, the plan being very simple and not attended with much expense.

*To the Editor of the Penny Mechanic.*

*(See Engraving front page.)*

Sir,—An invention, under patent, has lately been obtained, by which the lines

Digitized by Google

of window-sashes may be easily detached, for safety and convenience of cleaning. The expense of this invention is, perhaps, more than many persons would like to incur, as patentees usually employ their own workmen. I herewith, therefore, send you the diagram of a contrivance for the same purpuse, which can readily be attached to any sash, and I think will be found fully to answer the intention. Fig. 1. represents a piece of plate iron or brass, having holes drilled through as marked; the upper two to receive the wire staple, fig. 4, which must be riveted at the back, and through which the sash-line is to pass and be secured by the knot, fig. 5; the two holes near the bottom are to receive the ends of a piece of wire, when the sides of the iron plate are bent up to resemble fig. 2, and riveted. Over this piece of wire is an horizontal hole, about three-eighths in length, and only wide enough to admit the head of a screw hook, fig. 3, which is to be screwed into the sash, for the purpose of working and detaching. I think the diagram is the full size of the apparatus. If the box No. 2 was made in cast brass the expense would not exceed one shilling per sash. The hook, No. 6, I find however better adapted, both as regards safety and pecuniary views. The hook may be differently constructed, by a strip of iron bent to the form of No. 6, with a countersunk hole at each end to fit it on the sash with two common screws.

I am yours respectfully,
W. CLEMENTS.

## MECHANICS' LIBRARY.

*An address on the necessity of an extension of Moral and Political Instruction amongst the Working Classes.* By Rowland Detrosier. Cleave.

No book that we have hitherto noticed in this work better deserves a place in every mechanic's library than the above Address by Detrosier. A working man himself, he knew the evils and the misery that his class of society is exposed to; and as a man of intelligence, he has, in the tract before us, pointed out how the one may be avoided, and the other remedied. The plan is to improve the moral and political education of the working classes; and he advances the important truth which cannot be controverted, that *political melioration is the resulting consequence of moral progression.* There can be no doubt but that the degration and privations so often endured by the less wealthy classes of society, are the result of their ignorance. Yet how is this to be remedied? "Are there not thousands in this enlightened country whose circumstances bequeath to them little beside rising to labour and lying down to rest? Are there not thousands in this humane country, with whom labour commences almost before infancy has passed; thousands, the whole of whose education presents to them scarcely any thing more edifying than the examples of ignorance and brutality? Where is the individual bold enough to say no? They have, however, one redeeming virtue—industry! matchless industry!—to develop which no pains are spared, no means left unt.ied, that avarice can dictate, or poverty oblige its victims to submit to. They are, consequently, in the generality of cases, considerably advanced in their knowledge of the mechanical arts; and beyond this, it is still presumed by some, the education of poverty ought not to extend." This opinion, however, is giving way to the liberality of the age. People begin to perceive the evils such opinions have generated. The case is eloquently stated by Detrosier in the following passage: He says, "*Science creates wealth; but it is morality that perfects man;* and the greatness, the prosperity, the happiness of a nation, demand the inseparable union of both. Were some catastrophe of nature instantly to destroy the records of human intelligence at present existing in this country; to sweep away, in an instant, all those things on the existence and possession of which the comforts of life in the different grades of society dopend; to strip the land of all those witnesses of existing and past intelligence by which it is at present ornamented; and, sparing the population, to leave them the alternative of remaining destitute or constructing for themselves the requisites and comforts of life; who can doubt, for a moment, our physical power, or mechanical capacity, to extricate ourselves even from so forlorn a situation?

Digitized by Google

But let us ask the important question—are we as powerful in moral excellence as we are in mechanical skill? Were some political catastrophe to leave every man to be governed solely by the degree of knowledge which he, individually, might possess, what would be the scene presented to the eye of the spectator? What would be the moral consequence? What proportion of our population would be disposed to fulfil their moral engagements? What proportion would have principle enough to be a law unto themselves? Every one must feel the importance of these questions; the answer to which, were it possible to give it, would decide our claim to the character of a civilized nation, and show the amount of our moral excellence. A nation is civilized or savage, not in proportion to the morality or intelligence of the few, but of the many; for as the author of the Wealth of Nations has well remarked:—'Though a few individuals may possess great abilities, all the nobler parts of the human character may be obliterated and extinguished in the great body of the people.'" Our limits, we regret, will not allow us to do justice to this eloquent and powerful appeal to the intellect of the working classes—this heart-stirring call to "arise! or be for ever fallen." We can only say, we think so highly of it, that we hope every working man in the three kingdoms, who can read, will lay out *threepence* for a copy; and those who cannot read should purchase it, that those who can may impart to them the important truths with which this Address abounds.

## MISCELLANIES.

*Importance of practical Knowledge.*—It is a fact that some curious arts cannot be transported but by the workman himself. Most men will learn better by seeing the operation than by reading or any other method. This is illustrated in the following statement of a brass trinket maker of Birmingham, and is in substance as follows:—"Eighteen years ago, on my first journey to London, a respectable man asked me if I could supply him with doll's eyes; and I was foolish enough to feel half offended; I thought it beneath my dignity to make doll's eyes. He took me into a large room, and from the immense number of legs, arms, and trunks, I was convinced he wanted a great quantity of eyes. He gave me an order amounting to upwards of 500*l*. On my return, although I had some of the very best workmen in the glass toy line, yet they shook their heads, said they had seen the article before, but could not make it. I offered them great inducements to try their best, and after wasting much time the project was abandoned. Within a few months, however, I turned my attention again to the doll's eyes, determined to make them, if possible. After a while I met, by accident, a poor fellow in poverty from drinking, and dying of a consumption. I showed him ten sovereigns; he said he would instruct me in the process. He could not bear the smell of his own lamp, and though I was well acquainted with such work, I felt that it could not be done from his description. He took me into his garret, and before I had seen him make three I felt competent to make a gross; and the difference between his mode and that of my workmen was so trifling that I was astonished."

*Greenwich Railway.*—The number of passengers from Sunday, 5th March, inst. to Friday, the 9th, was 26,923. Money received 730*l*. 19*s*. The total number of passengers since the opening has been 239,354.

## INSTITUTIONS.

*London Mechanics' Institution.*—The usual quarterly meeting of this Institution was held on Wednesday evening, the 1st inst., when the Committee presented their Report, from which it appeared that the increased number of members had enabled the Committee to make several payments that, otherwise, they could not have done. The receipts of the quarter amounted to 546*l*. 18*s*. 1*d*., the expenses to 417*l*. 11*s*. The building debt had been reduced by the payment of 50*l*., and 109*l*. 7*s*. 1*d*. remained in the hands of the bankers. There were some accounts outstanding. Amongst the receipts of the quarter was 10*l*. 4*s*.

Digitized by Google

for single lecture tickets; this may, perhaps, account for the circumstance that only three ladies' tickets had been sold during the quarter. It also appeared from the Report, that considerable additions have been made to the library, 63 vols. of the "Public Records" having been presented by the Commissioners; and several other valuable books, by their authors, or by members of the Institution. The number of new members who had been elected was 331; the total number belonging to the Institution 1241. The report of the condition of the classes was very satisfactory. A class for the study of the Latin language was about being formed under the superintendence of Dr. Black. The books required by those members who attend it will not cost more than 5s. per member; but Dr. Black would not commence until he had obtained the names of 100 members willing to join the class. A short-hand class had also lately been commenced by Mr. H. Gregory, and met on Saturday evenings.

After the report of the Committee had been read and received, a motion for allowing the members of the Institution to attend the meetings of the Committee, without it being necessary to obtain their permission, was discussed, and the meeting afterwards adjourned till the next evening. The first motion having been put to the vote and negatived, one of a modified character was agreed to. Votes of thanks were then given to the different persons who had benefited the Institution, and the meeting adjourned.

*Colebrooke Literary Institution.*—The Rev. Robert Simson, M.A., Master of Colebrooke House Academy, well known as a lecturer upon education, and author of several works upon that important subject, on the 6th inst. delivered a lecture on Physical Geography, introductory to a course of twelve lectures on that department of science. The lecturer began with mentioning the importance of the study of geography, the more especially as we possess dominions in almost every latitude and every clime; and from the enterprising spirit of the British nation, there is not a corner of the world where some of her sons are not to be found. In a religious and moral point of view, the study of physical geography was observed also to be of paramount importance, because the physical condition of mankind reacts so powerfully on the moral, that the state of the former must be ascertained before the wants of the other can be supplied, or its deformities eradicated. From the excellence of the introductory lecture, the reputation of the lecturer, and the low price of admission (only *6d.* each lecture, or *5s.* for the twelve) we anticipate that many persons will be induced to attend.

---

LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday, March 20, at seven, C. C. Clark, esq., on early British Poetry.—Thursday, March 23, H. J. Gauntlett, esq., on Ecclesiastical Music.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, March 22, at half-past eight, Dr. Grant, on the Molluscous Classes of Animals.—Friday, 24, Institution closed.

*Aldersgate-street Institution*—Wednesday, March 22, at eight, H. Goadly, esq., on the Anatomy of Insects, illustrated by the oxyhydrogen microscope.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, March 23, at half-past eight, Dr. Lardner, on the Steam-engine.

*Eastern Athenæum*, Stepney Square.—Wednesday, March 22, at eight, W. Lukeing, esq., on Chemistry.

*Islington Literary and Scientific Society.*—Thursday, March 23, at eight, Mr. T Cromwell, on the Archæology of the British Islands.

*Poplar Institution*, East India Road.—Tuesday March 21, at eight, B. R. Haydon, esq., on Painting, with illustrations.

*Westminster Mechanics' Institution*, Grosvenor St., Millbank Row. — Wednesday, March 22, at eight, S. Logan, esq., on Phrenology.

*Kentish Town Mechanics' Institution.*—Monday, March 21, J. Smith, esq., on the Essentials of General Happiness.

*Bermondsey Mutual Instruction Society.*—Monday, March 20, at quarter past eight, Mr. L. Rickard, on the Steam Engine.

---

## TO CORRESPONDENTS.

We should feel obliged if our Correspondents, when describing machinery, would write shorter sentences. This would prevent ambiguity. Many of our friends use so many *pronouns* in their favour that we cannot ascertain the *nouns* to which these pronouns refer.

"W. D." and "Snully Gong," on **Land Skates**, next week.

We shall notice the "Engineers' and **Mechanics'** Encyclopædia" the very first opportunity.

"N. D." The Society of Arts will *not* **give a prize** for an invention if it is patented.

"Question" wishes to know "how it is that clay, unlike other bodies, contracts instead of expanding by heat?"

The Monthly Part of THE PENNY MECHANIC is published at Four-pence. The Cover and Index are not charged for.

---

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. XXII.] SATURDAY, MARCH 25, 1837. Vol. I.

## THE MECHANICAL POWERS.--NO. II.

FIG. I.

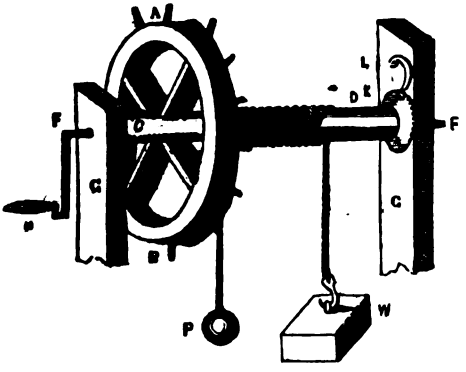



FIG. II.

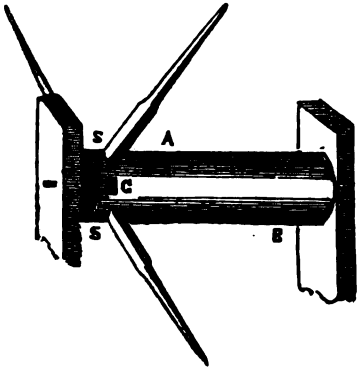
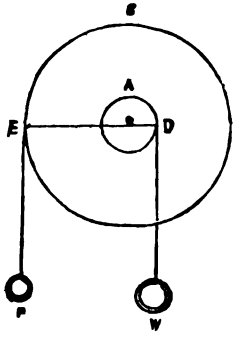



FIG. III.






Holloway Press: D. A. Doudney.

Digitized by Google

## THE MECHANICAL POWERS.

NO. II.

### THE WHEEL AND AXLE.

THE *Wheel and Axle* (Fig. 1.) is the second mechanical power; A B represent the wheel, and C D the axle, at the extremities of which are two pivots F F, which with the whole may turn in the wooden blocks G G. In this machine an equilibrium takes place, when the circumference of the wheel is to the power, as the weight is to the circumference of the axle. The weight to be raised is attached to the end of the rope coiled round the axle as at W, and the power or exertion required to raise it, is applied at the handles fixed in the circumference of the wheel, or at the end of a cord passing round the circumference as at P. The power gained by this machine is in proportion as the circumference of the wheel is greater than that of the axle, if the circumference of the wheel be twelve feet, and that of the axle only one foot, the advantage obtained by it will be as twelve to one, or a weight of twelve pounds at W, will be balanced by a weight of only one pound at P, and the least additional force at P, will cause the weight at W to rise, and *vice versa*. When the wheel and axle is employed for the purpose of drawing water out of deep wells, the winch or handle H F is in general used instead of the great wheel A B, for the weight to be raised in this case is not very considerable, there being but seldom more than one bucket drawn up at a time. When great force is required in order to lift any very heavy weights, as in the operation of raising different ponderous bodies to the roofs of houses, &c.; this instrument is made with cogs fixed all round the circumference of the wheel, and which is turned by a winch attached to the axis of a small trundle-wheel which works in the cogs. In this kind of machine the racket wheel K, with the catch L, is a very necessary appendage, for should the workman through carelessness quit his hold, while in the act of raising any heavy weight, the catch would fall into the teeth of the racket wheel, and prevent the danger which would most probably occur by the body descending at random. Sometimes in the place of a wheel long levers as in fig. 2. are used, which are inserted at one end of the axle in the orifices S S, and which may also be shifted from one orifice to another according to their most convenient positions; in this machine the power is to the weight, as the circumference of the axle A B is to the circumference of the circle described by the extremities of the levers, but this holds good only on the condition that the power is applied in a direction perpendicular to the lever, or that it is a tangent to the circle described by the lever. The power of this instrument may be increased either by lengthening the levers, or diminishing the thickness of the axle. The *capstan* which is a verticle cylinder, moveable on an axle, is turned in the same manner as the machine just mentioned, with levers, which are pushed round by the exertion of the men using them. In the wheel and axle as in all other machines, there must be an allowance made for the friction, which, although perhaps is not very considerable, must, in practice be taken into consideration. And it must likewise be taken as a fundamental law, that what is gained in power is lost in time, for the space, and consequently the time lost, will be in the same proportion as the power gained.

The machine used in copper-plate printing called a *rolling-press*, consists of two cylinders whose axles are fixed parallel to each other in the same blocks or frame, one of which is beneath and the other above a smooth horizontal plank placed between them; on the plank is laid the plate from which the impression is required to be taken, and also the paper which is to receive the impression, then by turning the upper cylinder by means of the levers (four in number) fixed on that part of the axle outside the block, the plank is passed between the cylinders, and the impression is taken; now in this machine the upper cylinder with the levers represents a sort of wheel and axle, but instead of its being used for drawing up any weight, it is used as a kind of gradual and uniform pressure upon the plate beneath it.

The *Jack*, an instrument of great importance in lifting timber and other materials, is composed of a straight iron bar with cogs on one side of it, moving perpendicularly in a wooden block or case, and is elevated or depressed by a

Digitized by Google

small toothed wheel, which being turned with a handle, works in the cogs. This is also referrible to the wheel and axle, for the power is applied at the handle, which by its circular motion describes the wheel, and the small toothed wheel which represents the axle, by working in the cogs of the iron bar, raises the weight required.

The wheel and axle may be considered as a *lever* of the *first* kind, so constructed as to have a continual motion on its fulcrum or centre, in consequence of which it has been termed the perpetual lever. Let A (fig. 3.) represent the axle and B the wheel, both of which turn on the same fulcrum C; now if the weight W act at that part of the axle at D, six inches from the fulcrum C, and the power act at that part of the wheel at E, two feet from the fulcrum C, it is evident that the machine gains power in the proportion of four to one, because the radius of the wheel is four times as great as that of the axle. To this mechanical power may be referred the various cranes, &c., almost continually under our notice.

## COTTON MANUFACTURE.

ENGLAND may be said to have been a manufacturing country for five hundred years, from the time, namely, when the clothiers of Flanders came over in great numbers and settled themselves in different parts of the kingdom, on the marriage of our Edward III. to Philippa of Hainault. The manufacture of cotton cloth, however, was not introduced among us till about the middle of the seventeenth century, and made no extraordinary progress for a hundred years afterwards. As an evidence of the comparatively slight degree of interest which it excited, and of the little ingenuity which was consequently exerted in its improvement, it may be stated that the valuable invention of the fly-shuttle, which was introduced into the woollen manufacture about the year 1738, was not employed in the weaving of cotton till more than twenty years afterwards; up to which period, whenever the web was more than three feet wide, two men were constantly stationed at the loom in which it was wrought, the one to throw the shuttle from right to left, and the other to throw it back from left to right. It was not till the year 1769 that an attempt was made upon any considerable scale to spin cotton thread by machinery; for, whatever may have been done before this time by individuals of mechanical ingenuity in inventing contrivances for that purpose, it is certain that the invaluable improvement in question was really introduced into the manufacture by Arkwright when he took out his patent and built his first mill.

The revolution, therefore, we may almost say, in the whole aspect and character of our manufacturing and commercial interests, which has hence arisen, is the work of only the last sixty years. About the beginning of the last century, the quantity of cotton wool annually imported into Great Britain did not amount to 1,200,000 lbs.; and by the year 1720 it had not increased to much beyond 2,000,000 lbs. There are no returns from 1720 to 1771; but the importation had probably gone on increasing during that interval, although at a slow rate. Nor did it make a very rapid progress even for several years after spinning by machinery was introduced, having from 1771 to 1775 averaged only 4,764,589 lbs., and for the next five years only 6,706,013 lbs. In 1784, the year immediately preceding the final repeal of Arkwright's patent, it amounted to 11,482,083 lbs. That event gave a great impulse to the manufacture, the average importation for the next five years having grown to 25,443,270 lbs. annually. In 1799 it had risen to 43,379,278 lbs., and in 1800, to 56,010,732 lbs. In 1817 it was 124,912,968 lbs., and in 1825 it actually amounted to the immense quantity of 228,005,291 lbs. The average importation of cotton wool into Great Britain may now be stated as considerably exceeding 200 millions of pounds per annum, or as amounting to fully a hundred times what it was a century ago, and to more than fifty times what it was when Arkwright began to spin.

The whole of this raw material, with the exception of about ten millions of pounds which are used in an unmanufactured state, and from ten to twenty millions which are annually exported, is spun into thread, and mostly wrought into cloth, in this country. The Rev. Dr. Cartwright invented his power-loom in 1784; but it is only since the com-

Digitized by Google

mencement of the present century that weaving by machinery has become general. Steam was first applied as the moving power for the spinning machinery in 1785; in which year Messrs. Boulton and Watt erected one of their rotative engines for a factory belonging to the Messrs. Robinsons at Papplewick, in Nottinghamshire. In the present day the cotton is carded, spun, and woven into cloth in the same manufactory; these different operations being performed by machinery, the several parts of which are all set in motion by a single steam-engine.

In 1787 the number of spinning factories in the county of Lancaster amounted only to 42, of comparatively inconsiderable magnitude; in August 1825, there were, according to Mr. Baines, no fewer than 104 such factories in Manchester alone, which were worked by 110 steam-engines, of the aggregate power of 3,598 horses. The number of steam-looms now at work in the kingdom is calculated at 45,000, of which about 8,000 are in Scotland, and above 20,000 in Manchester. In 1824, it has been stated that the number of spindles constantly in motion was about six millions, and the power by which they were moved equal to that of 10,572 horses. In another statement, however, drawn up by Mr. Kennedy, it is calculated that in 1817 (when the importation of cotton wool was not nearly so great as in 1824) the number of spindles was 6,645,833, and the moving power equal to that of 20,768 horses. Some idea may be formed of the growth of this manufacture since the year 1769, by contrasting the astonishing number of threads which it would thus appear are spun every day now, with the 50,000 which were all that were produced then.

The produce of all this machinery is, as may be supposed, immense. "In the present improved state of this (the weaving) process," says the writer of an article in the Supplement of the Encyclopædia Britannica, "one person, generally a girl, attends to two looms, the weekly produce of which is from seven to nine pieces of cloth, of seven-eighths wide, and twenty-eight yards long." "A single factory in Manchester," says Mr. Guest, writing in 1828, "and that not of first-rate magnitude, receives the raw cotton, and turns out a web of cloth, varying in width from three quarters of a yard to a yard and a quarter, of forty miles in length every week." In 1750, it has been calculated that the whole amount of the cotton manufacture of the kingdom did not exceed the annual value of 200,000*l.*; it is now considered on good grounds, to amount to fully thirty-six millions of pounds sterling per annum. Sir Richard Arkwright states, in his Case published in 1781, that the capital then invested in buildings and machinery by those engaged in this trade, amounted to 200,000*l.*; it is calculated to amount now, in Lancashire alone, which possesses about four-fifths of the trade, to 8,000,000*l.* In the year ending on the 1st of May 1818, 105 millions of yards of cotton cloth of all sorts were manufactured in Glasgow and the neighbourhood, of which the value was about 5,200,000*l.* Of this about one half was exported. The value of the cotton cloths, twist, and yarn, exported from Great Britain for some years past, has been on an average about 16,000,000*l.*, leaving of course about 20,000 000*l.* worth for home consumption. The export trade in cotton is now fully three times that in woollens, the manufacture of which used to be the great staple of the kingdom.

The extraordinary perfection to which every part of the cotton manufacture has now been carried is another result for which we are entirely indebted to the introduction of machinery. Especially since the invention of the mule, a compound of the jenny and the water-frame, about the year 1790, the muslins manufactured in England have been every year attaining a greater fineness of fabric, and are now rapidly approaching to a rivalry even in this respect with the most exquisite productions of the East. As an illustration of the state of advancement to which the spinning process has been brought, it may be mentioned, that "Mr John Pollard, of Manchester, spun, in 1792, on the mule, no fewer than 278 hanks of yarn, forming a thread of 238,520 yards, or upwards of 132 miles in length, from a single pound of raw cotton." The diminution of the price of the manufactured article which has been produced by the successive improvements in the cotton machinery is equally extraordinary. Yarn of what

Digitized by Google

is called No. 100, which even in 1786, after its price had been greatly reduced by the cancelling of Arkwright's patent, sold for thirty-eight shillings, has fallen in price every year since that time, and is now to be had for three or four shillings. The raw material is now indeed brought from India, and manufactured into cloths in England, which, after being re-exported to that country, are actually sold there cheaper than the produce of the native looms. There can hardly be a more striking proof than this of the triumph of machinery.

Finally, it has been calculated that while the number of persons employed in the cotton manufacture in 1767, did not probably amount to 30,000, the number of those now engaged in its different departments can hardly be less than a million. Yet, "in some branches of the business," it has been stated, "the spinning in particular, such is the economy of labour introduced by the use of machinery, that one man and four children will spin as much yarn as was spun by six hundred women and girls fifty years ago."—*Library of Entertaining Knowledge.*

### WOODEN BELLOWS.

It is somewhat singular that the inventors of most of our household instruments—those we use every day, and which add so materially to our enjoyments without our ever thinking of them—it is, we say, somewhat singular that in almost every case their inventors are unknown. The men who first taught others how to obtain fire, certainly effected as much, if not more, for mankind than Watt by his invention, or Arkwright, or anybody else, by his. Yet even fable is silent in the former case, while Fame with her thousand trumpets is sounding forth the certainly well-earned praises of the latter. Our readers must not suppose from this that we are going to introduce to their notice the name of any long-forgotten benefactor of his fellow-men; we should feel very happy in doing so, but at present we are only going to describe a very ingenious piece of machinery, the author of which is forgotten, but who certainly deserved to be remembered, if it were only for having done mankind what little service lay in his power. The machine we allude to is the wooden bellows.

After the discovery of fire, the first instrument employed to blow it, and strengthen it, would undoubtedly be a hollow reed, until the art was found out of forming a stick into a pipe by boring it. Our common bellows, which consist of two boards joined together by a piece of leather, and which probably are an imitation of the lungs of animals, appear to have been early known to the Greeks. Strabo states, that the Scythian philosopher, Anacharsis, who lived in the time of Solon, invented the bellows, and also the potter's wheel, and the anchor. Whether the two latter originated with him is doubtful, but it is interesting to think that the invention of an instrument so humble as a pair of bellows can be traced back for so long a period.

The wooden bellows were invented in Germany, but by whom is unknown. They are mentioned in a catalogue of various machines in 1550, and are stated to be capable of producing a strong blast for melting metals, and could also be used for organs.

The whole machine, as described in the History of Inventions, consists of two boxes placed the one upon the other, the uppermost of which can be moved up and down upon the lower one, in the same manner as the lid of a snuff box, which has a hinge, and moves up and down when it is opened and shut. The sides of the uppermost box are so broad as to contain the lower one between them, when it is raised to its utmost extent. Both boxes are bound together where the pipe is through which the air is forced, by a strong iron bolt. It may be readily comprehended that when both boxes fit each other exactly, and the upper one is raised over the under one, which is in a state of rest, the space contained by both will be increased; and consequently more air will rush in through a valve placed in the bottom of the lower one; when the upper box is forced down, this air will of course be expelled through the pipe. The only difficulty is to prevent the air which forces its way in, from escaping anywhere else than through the pipe;

Digitized by Google

for it is not to be expected that the boxes will fit each other so closely as to prevent entirely the air from making its way between them. This difficulty, however, is obviated by the following simple and ingenious method. On the inner side of the uppermost box there are placed moveable slips of wood, which by means of metal springs are pressed close to the sides of the other box, and fill up the space between them. As these long slips might not be sufficiently pliable to suffer themselves to be pressed close enough, and as, though planed perfectly straight at first, they would in time become warped in various directions, incisions are made in them across their whole length, at the distance of from fifteen to eighteen inches from each other, so as to leave only a small space in their thickness, by which means they acquire sufficient pliability to be everywhere pressed close enough to the sides.

This is a description of the method by which these bellows were manufactured some twenty or thirty years ago: several improvements will, however, no doubt suggest themselves to the mind of the ingenious mechanic. The advantages of these bellows are said to be very great. When made of clean fir wood, without knots, they will last, it is said, thirty or forty years, and even longer, though continually kept in action forty-six or forty-eight weeks every year. The effect produced by them is stronger, as well as more uniform, than by the ordinary bellows, and the blast of air can be moderated according to circumstances. They are worked also with great facility. The slips of wood on their sides are apt to become damaged, but they can easily be repaired. Every three or four months, however, the outer sides only of the inner box, and the bolt which keeps the boxes together, must be smeared with oil.

Grignon, when speaking of the above invention, and noticing its German origin, says, "Germany is the country of machines. In general the Germans lessen manual labour considerably by machines adapted to every kind of movement; not that we are destitute of able mechanics; we have the talent of bringing to perfection the machines invented by our neighbours." When a somewhat similar observation was made with reference to gentlemen's "ruffels," it was observed, that though "our neighbours" might have invented this once much esteemed and fashionable portion of dress, yet it was the Englishman who had the "talent of bringing it to perfection," by adding a shirt to it. It will be found pretty nearly the same with most other inventions. There are few, or no countries in the world at the present time, that can boast of the possession of so much mechanical skill as England; and Grignon's remarks, whether relating to a pair of bellows, or to any thing else, will therefore now be quite inapplicable.

## LAND SKATES.

*To the Editor of the Penny Mechanic.*

Sir,—In perusing in your Magazine an article headed "Land Skates," it struck me that the spindle of the wheels could not be made to support a man's weight. I do not conceive where you could put the bearings for the spindles; they would either bend or break; besides you could not get the wheels strong enough for that purpose on such a small compass as they are proposed to be on. If you think these hurried remarks worthy of a place in your useful work, an insertion will oblige

Your most respectful
W. D.

## LAND SKATES.

*To the Editor of the Penny Mechanic.*

Sir,—I observe in the last number but one, of your Magazine, a correspondent who signs himself "H. Baker," suggests a plan for skating on dry ground by means of an article which he calls Land Skates, and at the end of his communication he begs one of your kind correspondents to acquaint him whether he is right or wrong in his idea. I therefore, (being naturally of a *kind* disposition), beg to acquaint the said gentleman, that he is most decidedly wrong; though his plan might be improved upon so as to render it efficient. In the way that he proposes there would be too much *friction*, and though he might manage to

Digitized by Google

get on a little way, yet to keep up would be utterly impossible; but, if the middle wheel of both skates was made a little larger than the rest, I have no doubt but what it might answer, for in that case, though the other wheels would be of use in the first starting, yet when at full speed, you would be entirely skating upon the larger wheel—indeed, I doubt whether in the way that Mr. Baker proposes he would be able to turn, whereas by the simple addition that I propose, he might do so with perfect ease.

Yours Obediently,
SNULLY GONG.

*** WE think if our correspondents will test their theories by *experiment*, it will be found that travelling in the way they propose is more difficult than they imagine. We question whether there would be sufficient friction between the wheels and the earth to enable them to proceed at all, at any rate if the edge of the wheel is to be used in the same way that the edge of the skates is on the ice, for the purpose of propelling the body forwards, the land skates will not last many journeys.

## IMPROVED CONDITION OF THE WORKING CLASSES.

SIR,—If you intend that your Magazine should be of any use to the working classes, you should keep out of it, all doctrines of political economy, and more especially those of the Brougham, Martineu, and Malthus school. You may depend upon it, Sir, that you may write on till doomsday, but you will never make the working classes believe, that they are so well off as they ought to be, or that they ought to be content with their present condition. Look, Sir, at the dreadful state of the Spitalfield's Weavers at the present time. Look at the dreadful state of hundreds of thousands of the working classes, in the manufacturing districts of this country. Why, Sir, their condition is such, that it is nothing but the "strong arm of the law," that keeps them from breaking out into open *rebellion*.

But, Sir, you must know all this, you must know that the present condition of the working classes, (generally speaking) is awful in the extreme. Then why seek to pervert the truth? Why seek to make the working man believe, that he ought to be content? Why seek to defile the pages of your (otherwise excellent) work, by such vile doctrines as those you have put forward, under the head, "*Improved* Condition of the Working Classes?"

Believe me, Sir, I thought much of your work, prior to the insertion of the extraneous matter I have referred to, but now I look at it with something like loathing. And, Sir, if you do not desist, I shall cease to be a subscriber, and I know very many that will do the same, therefore I hope you will explain yourself in your next Number.

I am, Sir,
Yours, &c.,
J. D. G.

P. S.—Depend upon it, Sir, that the time has gone by when the working classes of this country, are to be cajoled into a belief, that their present political condition, is what it ought to be.

*** WE publish this letter *verbatim* as we received it, for the purpose of showing, not only how much mistaken J. D. G. is respecting the tendency of the article to which he refers, but also, that he is wrong in supposing that if it is admitted the working classes are better off now than they were a century or two ago, that therefore they should "be content with their present condition."

If our readers will do us the favour to refer to the articles on "the Improved Condition of the Working Classes," in Numbers 19 and 20, they will then be able to judge whether there is any thing in those papers calculated to excite the "*loathing*" of J. D. G., and whether we have perverted the truth, or inculcated vile doctrines. Without assenting to the doctrines of political economy propounded by "Brougham, Martineau, and Malthus, (which are not in *any way* introduced in the article), we cannot see why, without any reason assigned, we should be so strongly warned to keep them out of the Penny Mechanic. We address our readers as intelligent beings, who *reason* upon what they read. We do not suppose them such idiots as to assent to a proposition merely because they see it in print. We are sure they will form their judgment for themselves, and we should therefore hold ourselves guilty of a crime if we endeavour to smother an opinion *merely* because it happened to be opposed to our own. J. D. G. need not, however, be afraid that we shall introduce the subject into our pages. We have a better reason for refraining. We do not wish to make this work the vehicle for *any party*; much less a *political* one. Politics therefore we eschew.

Our correspondent appears to think the tendency of the article is bad, because it

Digitized by Google

endeavours to prove that the working classes are more comfortably situated now, as a body, than they have been heretofore. We stated facts. We did not manufacture them. They are a part of history, and the works from which they are taken, merely record what has happened. The conclusion we draw from these facts is, however, very different to that of J. D. G. It appears to us, that if the condition of the working classes has been progressively improving, there is no reason why it should not continue to do so. Why if they are better off now than they were fifty years ago, (we speak of the whole body) that they should not be still more improved, physically and mentally, fifty years hence, than they are at present. This is the just conclusion that should be drawn. If men were content to remain stationary instead of endeavouring to progress—to improve in knowledge and in virtue—there would be an end to all the hopes of those who look forward to the time

> When man to man, o'er all the earth,
> Shall brothers be and a' that.

Instead, therefore, of wishing any one to remain "content," in this sense of the word, we shall always do all we can to make him aspire to become a wiser and a better man, than he ever can be if he is content to remain ignorant of his duties and his rights.

*Steam Plough.*—The Highland and Agricultural Society of Scotland has offered the premium of 500*l.* for the first successful application of steam power to the cultivation of the soil. We presume from this that the steam plough invented and used in June, last year, by Mr. Heathcote, M.P. for Tiverton, has not proved successful.

*To preserve Boots and Shoes from Cracking.*—My boots being damp the other day, I placed them on the top of an iron stove, with the intention of their remaining a few seconds only. Being suddenly called away on other business, I forgot my boots. When I returned they were pretty well roasted. Being afraid they were spoiled, I applied lamp oil to the burnt part until it would receive no more. This was to keep them from cracking. Since that time they have been more impervious to moisture, very hard, and I have no doubt will wear the longer for it. I have been told by a first-rate bootmaker that linseed oil would have been better. This hint may be improved by others.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday, March 27, at 1 o'clock, afternoon, R. Bond, esq., on Physical Geography.—Thursday, March 30, at seven, H. J. Gauntlett, esq., on Ecclesiastical Music.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, March 29, at half-past eight, Dr. Grant, on the Molluscous Classes of Animals.—Friday, 31, M. Foggo, on Taste in Literature and the Arts.

*Aldersgate-street Institution*—Wednesday, March 29, at eight, H. Goadly, esq., on the Anatomy of Insects, illustrated by the oxyhydrogen microscope.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, March 30, at half-past eight, Dr. Lardner, on the Steam-engine.

*Eastern Athenæum*, Stepney Square.—Wednesday, March 29, at eight, C. C. Clark, esq., on the old Ballads.

*Islington Literary and Scientific Society.*—Thursday, March 30, at eight, Mr. T. Cromwell, on the Archeology of the British Islands.

*Poplar Institution*, East India Road.—Tuesday, March 28, at eight, J. Howell, esq., on Astronomy.

*Kentish Town Mechanics' Institution.*—Tuesday, March 28, J. Smith, esq., on the Communication of truth.

*Bermondsey Mutual Instruction Society.*—Monday March 27, at eight, J. J. Hawkins, esq., on Popular Education.

### TO CORRESPONDENTS.

"Charles J—s." Both letters shall be attended to. The caution in the one first received it is not necessary to publish.

"A Reynolds." We cannot promise to insert his paper for some little time, but it shall not be forgotten.

"J. R. W." The same answer will apply to this correspondent.

"R. W." Shall be answered.

"O. P. Q." The Thames Tunnel has 4000 shareholders at £50 each. This sum has been paid upon each share, yet they can now be bought for £7 10s. each. We believe government has advanced £20,000 to complete the undertaking, and it now appears likely to be brought to a successful termination.

Received, letters on "the Results of Machinery," from "J. W. Ritchie."—"An admirer of Science, but an hater of exclusiveness," and "S."

"W. Wivell" shall hear from us by post.

We have not received the list yet from the "Tower Street Society."

In our notice to correspondents last week, the word "Favor," should have had "s" at the end of it, this will alter the sense a little.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

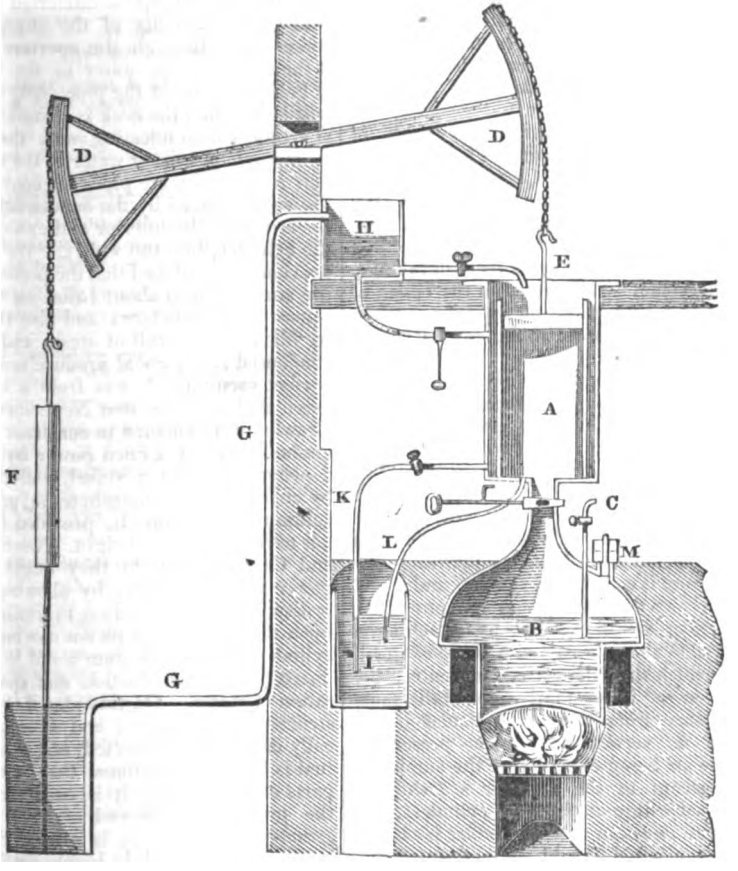
Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. XXIII.] SATURDAY, APRIL 1, 1837. Vol. I.

## THE ATMOSPHERIC ENGINE.




Vol. I.—No. XXIII. Holloway Press. D. A. Doudney.

Digitized by Google

## THE STEAM ENGINE.

NO. VII.

THE greatest improvements in machinery have generally been made by working men; and however honourable it may be to them that the spinning machine owes its excellence to one of their number, it is still more to their honour that the Steam Engine is entirely the result of *their* ingenuity. Whatever may be thought of the Marquis of Worcestor's invention, it is quite certain that all he made known had previously been discovered; but whether this were the case or not, the improvements in the Steam Engine we are about to describe, and those which were afterwards invented, were certainly not caused by his lordship's experiment.

In 1707, a plumber and a smith, of the town of Dartmouth, Thomas Newcomen, and John Crawley, made the most important improvement in the Steam Engine of any we have yet described. They constructed what is termed the *Atmospheric Engine* (see engraving). The steam is generated in the boiler B, and is admitted into the cylinder A, when the piston is forced to the top as represented in the engraving. D D is a large beam or lever, moving on an axis, and supporting at one extremity the rod E of the steam piston, by means of a chain passing over an arch of wood at the end of the lever or working beam. The reason for employing this arch will be obvious, if we consider that the distance of the extremity of a common lever from a perpendicular beam supporting the fulcrum is continually varying, and would therefore draw the piston rod out of its vertical direction; but by attaching a flexible chain to part of a circle of wood, of which the fulcrum is the centre, the piston rod is constantly kept at the same distance from the perpendicular beam, and its vertical motion is preserved. The air being expelled by the admission of steam to the cylinder A (which is placed within an exterior cylinder), the communication with the boiler is closed, and a portion of cold water admitted outside the cylinder from the reservoir H, which instantly condenses the steam, and forms a vacuum below the piston, which is then forced to the bottom of the cylinder by the pressure of the atmosphere. To the opposite end of the lever beam the pump-rod is suspended, furnished with a counterpoise F, to elevate the piston-rod after its descent in the cylinder. The piston being thus alternately elevated and depressed, a quantity of water will be raised from the well at every stroke of the engine, in proportion to the force with which the atmosphere presses upon the piston. M is a safety-valve, and C a small pipe descending into the water in the boiler, for the purpose of ascertaining the quantity it contains; for if the cock at C is opened while the lower extremity of the pipe is immersed in the water, the elasticity of the steam will force water through the aperture; but if the surface of the water in the boiler is below the end of the pipe, only steam will issue when the cock is turned. G G is a tube communicating with the well to supply condensing water to the reservoir H. K and L are pipes for conveying the water formed by the condensation of the steam on the interior and exterior of the cylinder, into the well I. We have previously mentioned that the pressure of the atmosphere is about 15lbs. on every square inch of surface; and also that if we filled a vessel full of steam and then condensed it, we could produce nearly a perfect vacuum. It was from a knowledge of these facts, that Newcomen and Crawley were enabled to construct their engine. Savery gained power by condensing steam in a vessel, and thereby enabling the atmosphere to press a column of water into it, provided it did not exceed a certain height. Newcomen and Crawley thought they might gain power more certainly, by allowing the pressure of the atmosphere to act directly upon the surface of a piston moving in a cylinder, where a vacuum could be produced by the introduction and condensation of steam. On this idea they constructed their engine; and so economically can it be constructed, and so effectual is it in its operations, that in many parts of the country it is used even in the present day instead of those constructed by Watt. It is evident that a piston moving air-tight within a cylinder would be forced upwards if steam was admitted under it, and that if this steam were condensed, the pressure of the air would be sufficient to force it down again, thus producing a motion that could easily

Digitized by Google

be communicated to different kinds of machinery, besides being employed in raising water; this engine therefore possessed an immense advantage over that of Savery, and all that had previously been invented. In consequence, however, of Savery having been the first to apply the principle of condensation, it was found requisite by Newcomen and Crawley to enter into an arrangement with him, and accordingly his name was inserted in the patent along with theirs.

[We are sorry we cannot continue these papers oftener, but we wish to *illustrate* the description of every engine, and this causes the delay.—Ed.]

## INTEMPERANCE.

Last, though not least, in the catalogue of esssentials to the increase of moral force, let the poor man be too proud to be a drunkard; or let him be discarded from the society of those who advocate good government and the cause of suffering humanity. Proclaim to the working classes, from morn to night-fall, that no political change can effect the melioration of his condition who is the slave of drunkenness; and add to it this important truth, that political melioration is the resulting consequence of moral progression. With what consistency can that man reprobate the bad government of his country, who practises not good government at home? Or how shall that father reprove his child for immorality, who is himself an habitual drunkard? The vice of drunkenness is that which more especially unveils the deficiency of moral culture in this country. We affect an abhorrence of the crimes of savage life; yet, if whilst exulting in the superiority of our attainments, were we to institute a comparison between the lowest state of savage existence and that of the brutal and confirmed drunkard, our pride might receive a salutary check, in the conviction, that even cannibalism is scarcely more odious than drunkenness. The cannibal exists in a state of moral infancy, in which we discover that entire absence of governing principle,—that absolute freedom of will which has so often occupied the attention of philosophers, and in praise of which, partial knowledge has frequently had so much to say. Unchecked by considerations of humanity or moral feeling—unrestrained by a sense of right or wrong—the cannibal sits down with exultation to the war-feast of victory and joy; and whilst devouring the dead body of his slaughtered foe, constitutes the true representation of freedom of will. In contemplating such a state of savage existence, in such a moral desert, enlightened humanity is shocked at the commission of crimes for which nobody blushes, because they are permitted by all. Nor is this to be wondered at. Living in a state of society in which unrestrained will is the only governing principle—in which he is most reverenced who is most to be feared—in which cruelty is the redeeming virtue, not the odious vice—every external influence operates to produce a character ruthlesss in principle, and cruel in deed. Murder, torture, treachery, and deceit, are among the virtues, not the crimes, of the lowest stages of human existence. Shame, in such a state, has not yet spread its tell-tale hue over the countenance of man; and a good conscience, the offspring of moral education, is unknown. With no good principle to appeal to—no law to control—what but the most despotic authority could govern a society of individuals such as these? And what principle has the brutal and confirmed drunkard? What law is strong enough to control him? What is his superiority over the cannibal? Is he checked by considerations of humanity or moral feeling, or restrained by a sense of right or wrong, when, daily sitting down to the feast of his cups, he swallows, at each repeated draught, not, indeed, the body of a slaughtered foe, but the happiness and well-being of his wife and children, nor blushes at the deed which consigns them to wretchedness and want? And shall such beings prate about liberty and equality? The liberty they desire is the liberty to do wrong; and to descend to an equality with such individuals, is a degradation to which no honest man will stoop. Herding with society in which unrestrained will is the only governing principle—in which he is most reverenced who is most reckless—every external influence operates to the degradation of the man, and the increase of brutality. Witness the horrid spectacle of the domestic scene. The sound of his foot is the signal of fear,

Digitized by Google

not of joy. The father that should protect, is coming home to abuse; and the child clings to its trembling mother in a frail, fruitless, but holy effort, to form a barrier of affection between her and brutality. Almost exhausted from the want of a sufficiency of food, half naked, and wholly wretched, the pitiable partner of this human monster sues with fear and trembling for the miserable pittance which his brutal habit has spared for them. This picture of human degradation lacks but one more character to render its odiousness complete—the drunken mother. Then, indeed, the cup of domestic wretchedness is filled to the brim, and poverty, disease, and crime, are secure of their victims. If humanity is shocked at the supposed existence of such wretchedness, what must be the state of feeling on contemplating the reality? Drunkenness is the crying sin of this country, and its debasing consequences are manifest in thousands of instances, in the poverty and immorality of its victims.—*Detrosier.*

## METHOD FOR FINDING THE WEIGHT OF A SHIP,

WITHOUT KNOWING ITS MAGNITUDE OR FORM.

THE following method for finding the actual weight of floating bodies, suggested itself to the writer (Wm. Walker, Esq., Assistant Mast.-Attendant of H. M. Dockyard at Devonport,) by observing that a 78-gun ship floated deeper in the river Medway, at low water, than at high tide; "I am induced (says he) to publish it, because some persons may have conceived it impossible to find the weight of a ship without knowing her form, magn tude, and displacement. I am, however, of opinion, that the following is the only true method by which the actual weight of a ship can be ascertained: it is by this, weighed as by the hydrostatic balance.

"*Ex.* 1. A ship at London had her water-line marked very exactly, and a certain quantity of the Thames water weighed 1000 lbs.: on the ship arriving at Sheerness, it required 25 tons additional weight, to bring her down to her water-line marked at London; a quantity of the water in which she floated, equal to that weighed at London, was found to weigh 1026 lbs.; required the weight of the ship in air when she left London?

"Floating bodies displace a quantity of fluid, equal in weight to themselves. By this principle, the displacement at London and Sheerness, although different in quantity, was equal in weight to the ship; therefore the difference of displacement, in the two fluids, bore a certain ratio to the whole: this difference was equal to 25 tons. It was also found, that a certain quantity of the river water weighed 1000 lbs., and an equal quantity of sea-water 1026 lbs.; therefore their difference, 26 lbs., will be to 1000 lbs. as 25 tons to the weight of the ship in the atmosphere. As 26 lbs.: 1000 lbs.:: 25 tons = 961 tons 10 cwt. 3 qrs. 2-four twenty-sixths lbs.

"*Ex.* 2. The line of floatation of a yacht was carefully marked in salt-water, a certain quantity of which was found to weigh 103 lbs. imperial; the vessel was then moved into a river, and seven tons ten hundred weight was taken out of her, to bring her to the line of floatation marked at sea. A quantity of the river water, equal to the salt water weighed before, was found to weigh 100 lbs.; required the weight of the yacht in the atmosphere, and her displacement, in cubic feet, at sea, supposing a cubic foot of sea-water equal to 64 lbs.?

| Lbs. | Tons. Cwt. | Tons. | |
|---|---|---|---|
| As 3 : 100 : : 7 | 10 | = 250, | the weight of the vessel when in the river. |
| As 3 : 103 : : 7 | 10 | = 257½, | the weight of the vessel when at sea. |
| As 64 : 1 : : 257½ | | = 9012½ | cubic feet displaced. |

"*Ex.* 3. A collier's water-line was carefully marked at sea, and a quantity of sea-water was found to weigh 51 lbs. 8 oz. On her arrival at London, 20 tons of coals were taken out to bring her down to her former water-line; and a quantity of the Thames water, equal to that weighed at sea, was found to be 50 lbs.; required the weight of the vessel and stores, supposing her cargo, when complete, to have been three hundred tons?

| Lbs. | Tons. Tons. Cwt. Qrs. Lbs. | |
|---|---|---|
| As 1.5 : 50 : : 20. | = 666 13 1 9½ | in river. |
| As 1.5 : 515 : : 20 | = 686 13 1 9½ | at sea. |
| | Deduct cargo 300 0 0 0 | |
| | 386 13 1 9½, | wght. of the vessel and stores." |

—*Papers on Naval Architecture.*

## STEAM BOILERS.

*To the Editor of the* PENNY MECHANIC.

SIR,—If you will have the kindness to insert the following in your very valuable work I shall feel greatly obliged, as I wish to point out a few inaccuracies in Mr. King's sketches and remarks upon feeding boilers.

Digitized by Google

The remarks of Mr. Puttich, p. 124 in No. 16, are very correct as it regards the pressure of steam in the boiler, forcing up the water valve shown by Mr. King in No. 9. Although his sketch is by no means correct; for if you observe, he does not tell us, neither does Mr. King in No. 21, what becomes of the water forced by the feed pump after their cocks in the service pipe to the boilers are shut, which they of course are when the water is of sufficient height in the boilers. Mr. King's suggestion in fig. 1, No. 9, is by no means new, because it is very similar to the old way of supplying low pressure or condensing engines. If your readers turn to your double number, 13 and 14, and compare the two drawings, they will find them very similar as it regards the float, the steel yard, and valve. It would be as impossible to fill a boiler, in the manner Mr. King states in fig. 1, No. 9, as it would be to keep steam up without fire. Whatever power the pressure of steam is on the square inch in the boiler you must have a greater power to force the water in to overcome the resistance of steam. What power has Mr. King in his small cistern of water on the top of the pipe F to overcome the resistance of perhaps 30 or 40 lbs. pressure on the square inch in the boiler. I can assure you, and I defy any practical man to contradict me, that not only would his cold water be forced away, but the pressure of steam in the boiler would force all the water out. If you turn to your drawing, p. 104 in your double number, you will find in *low*-pressure engines they are obliged to have the pipe (which Mr. King in No. 9 fixes on the top of the boiler) very high. As some of your readers may not know the reason of this, as your correspondent has not mentioned the subject, and also as I wish to convince Mr. King of his error, allow me to state it. The weight of the column of water on the square inch at the lower end of the pipe, where the water comes into the boiler, must always exceed the pressure of steam on the square inch in the boiler, or the steam would force the water back. As low pressure or condensing engines are seldom marked at more than 6 lbs. pressure on the square inch these columns are generally about 14 or 15 feet high. It is for this reason that feed heads, which is the name for these columns, cannot be used for high pressure engines, because, if you work a boiler at 40 lbs. pressure on the square inch you would require a column about 65 feet high.

The usual method, therefore, of supplying high-pressure boilers is by a feed or force pump worked by the engine. There are various ways of regulating the supply of water to the boiler, so as to keep the required height, one of the best of which, if you deem it worthy of insertion, I shall be happy to forward you; it is not an idle supposition like Mr. King's, *as we have it at work daily*. As we are obliged to use a pump for high pressure engines you will immediately see the truth of my question to Mr. King; which is, when the cock under the small cistern in No. 21 is closed, there being sufficient water in the boiler, where is the water to go which is being pumped by the feed pump of the engine? if there is no outlet, you would either break your pump or the connexion of the pump to pieces. If he makes a waste pipe similar to his drawing H in fig. 1, No. 9, he must recollect, should his engine stop when the cock is partly open, the pressure of steam in the boiler will send all the water in the said boiler up the pipe D in No. 21, through the cock and through the waste pipe as shown by H in No. 9, let his holes in the pipe be ever so small. One remark in conclusion,—I say, if the engine *stops* when the cock is partly open, because while the engine is at work the power with which the piston of the pump is forced down counteracts the pressure of the steam on the square inch in the boiler. There are other remarks I could make on fig. 2, No. 9, the force pump No. 20, and also his drawing in No. 21; but I will not take up more of your valuable time. Should you feel inclined to insert this, I will forward you the sketch I promised above, and am, sir,

Your's most respectfully,

CHARLES J——s.

*Somers Town, March 20, 1837.*

Digitized by Google

### RESULTS OF MACHINERY.

*To the Editor of the Penny Mechanic.*

SIR,—Your impartiality in inserting in the columns of your valuable periodical, the letters both *pro* and *con*, on the interesting subject of the results of machinery, induces me to hope that my view of the matter may meet with the same favour.

With the writer who stated the objections to machinery I partly agree; but with the answers to those objections, by the writer in your last number, I wholly dissent.

To instance one of the propositions, by him adduced, as an answer to those objections, mentioned in the first letter, will answer my purpose; he says, that as machinery has enabled the master manufacturer to dispense with a portion of labour there has been a consequent saving, not to such person individually but to the community in general, but who, I would ask, does not see that in the present state of society and politics the saving would go to give an increase to the comforts and luxuries of such manufacturer, and not in the remotest degree to meliorate the condition of the toil-worn labourer.

Though I am not, either in practice or theory, a machinist, I am in *heart* an admirer of the progression of mechanical science; and as such, if I were able, I would vindicate the right of the millions to participate in the benefits it confers.

What are the discoveries of the powers of machinery but an application of principles eternal in their duration and immutable in their character, made for no man nor class of men but universal in their adaptation, of equal benefit to all? Paine says, "the principle by which the lever acts is a thing distinct from the instrument, and would exist if the instrument did not; it attaches itself to the instrument after it is made." Did the elasticity of steam exist before a Watt or any body else applied it mechanically?

Seeing that these questions must be answered affirmatively, why should a particular caste assume to themselves the exclusive right to the benefits arising from the application of these principles? yet it is lamentable that this is a view of the case that seldom opens on the visions of men; nay, this would militate against the fact, the intolerable fact, that the millions are considered to be, as Rowland Detrosier emphatically said, "human machines for the creation of wealth, whose physical education in the adaptation of their power to mechanical purposes is all that is thought of."

I am, Sir, an Admirer of science,
but an Hater of exclusiveness.

March 19, 1837.

### HILL'S ROTARY PRINTING PRESS.

*To the Editor of the Penny Mechanic.*

SIR,—In Lardner's Cyclopœdia "Manufactures in Iron and Steel," vol. 2, p. 219, will be found the following account of a method of printing exactly similar to Mr. Hill's, and which, as the extract will show, was invented by Mr. Nicholson.

"So early as the year 1790 Mr. Nicholson obtained a patent for a machine for printing on paper and other substances by a more neat, cheap, and accurate method than by the presses at that time in use. His plan was to cast the letters, &c, tapering on the shank, or in other words, as the segment of a circle agreeing with the periphery of a roller, upon the surface of which these types are to be firmly imposed in the same manner as common letters are imposed upon a flat stone. He likewise applied the ink or other colouring matter to his types by means of stuffed rollers or cylindrical brushes. On these accounts he is considered by some persons to deserve the credit of having first suggested the idea of that system of machine printing now under notice, &c."

From the above extract it appears quite clear that this method is by no means so new as I first was inclined to think.

By the insertion of these remarks and the extract, you will oblige, sir,

Your's truly,

C. D. T.

March 25th.

Digitized by Google

## PERPETUAL MOTION.

*To the Editor of the Penny Mechanic.*

Sir,—Permit me to offer a few remarks to prove the fallacy of J. W. Ritchie's plan, (which I observe in No. 20 of your magazine,) of obtaining perpetual motion by means of springs. H. says, that "he does not intend it should supersede the power of *steam*, but that it really would be useful to turn a coffee mill or draw water;" but so far from doing either, it would not move at all! the two springs would find an equilibrium of pressure and then be steady. What is to move one down? exactly the same amount of power of one spring could not overcome exactly the same power of resistance of the other, for it is an axiom in mechanics, that the moving power must always be greater than the amount of power it is required to communicate to overcome its own friction and the friction of the machinery it moves, hence perpetual motion can NEVER be mechanical. Mr. Ritchie's plan may be compared to two men knocking each other down as they become weak and strong alternately, the stronger knocking down the weaker, as it is precisely on the same principle.

Trusting that the truth of these remarks will at once show the fallacy of J. W. R.'s suggestion, and at the same time that it will obtain a place in your magazine.

I remain, sir, your's, &c.

BRACK'S BROTHER.

## LAND SKATES.

*To the Editor of the Penny Mechanic.*

Sir,—With your leave I wish to state a few words respecting the Land Skates. In due respect to Snubby Gong, with his natural kindness of disposition, and W. D. with his impossibility as to their being able to turn or support a man's weight; these two gentlemen will be pleased to pardon me—they are both wrong—and H. Baker, in the theory he advances, is quite correct, yet there is a misfortune in it for him, which is an invention of eight or ten years standing of the same description of skates, that were sold by the inventor somewhere in Piccadilly; and many of your correspondents, I have no doubt, if they have been at all play-goers, may bring to their recollection a Dutch frost scene, which was exhibited on Covent Garden stage, in a pantomime, a few years since. In this scene was much skating, which was dexterously performed on these said land skates; their turning seemed to be accomplished by lifting one foot and turning it, whilst the other runs forward. I have also seen them in streets, on pavement; but the reason they are not generally used I know not.

Your's, obediently,

Strand, March 27th. A. R.

---

Mr. Editor,—After so much discussion on the subject of Land Skates, allow me to refer your readers and correspondents to the article "Skating" in the British Cyclopœdia, or in Hebert's Mechanics' Cyclopœdia, now publishing, H. Baker, W. D., and Snubby Gong, will there find that they have been making "much ado about nothing."

March 25th. RECTIFIER.

---

*Patents in America.*—By an official document laid before Congress, it appears that no less than 6000 inventions have been secured by patent since the establishment of the Patent Office in 1793. The plough has been made to undergo 124 improvements; 119 threshing machines have been invented. That great problem, the extraction of butter from cream, without fatigue to the operator, has been solved in 80 ways by the inventors of eighty churns; and the laundress has been allowed her choice out of 125 machines; 123 machines have been invented for making nails; the number of new spinning machines exceeds 100; the number of improvements in the loom is 73; and in the manufacture of hats 43; the number of steam-engines exceed 100; that of stoves is nearly the same; there have been 42 new ways contrived for manufacturing combs; 4 new machines for paring apples have been invented, and 3 gridirons; pencil-cases, ramrods, razors, and suspenders have each been subjected to various improvements. An invention has been patented under the name of "dog-power," another termed an "elevator of pots and kettles," and a third, destined for a useful domestic purpose, under the very sonorous Greek name of "Hacmagalactophorus."—*Repertory of Patent Inventions, March* 1832.

Digitized by Google

*Greenwich Railway.*—The number of persons who have travelled on the Railway during the past week has exceeded the most sanguine expectations of the proprietors. On Monday alone upwards of 10,000 persons passed to and fro from Greenwich and London. We have not heard that any accidents occurred.

*Oil for delicate Machinery.*—The oil for diminishing friction in delicate machines ought to be completely deprived of every kind of acid and mucilage, and to be capable of enduring a very intense degree of cold without freezing. Chevreul's process consists in treating the oil in a matrass with seven or eight times its weight of alcohol till boiling. The liquid is then to be decanted and exposed to the cold; the *stearine* will then separate from it in the form of a crystallized precipitate. The alcohol solution is afterwards to be evaporated to a fifth part of its volume, and the *elaine* will then be obtained, which ought to be colourless, insipid, without smell, and incapable of altering the colour of the infusion of litmus or turnsale, and having the consistence of pure white olive oil.

*Cement for rendering Joints Steam-tight.*—The following receipt forms a strong and durable cement for joining the flanches of iron cylinders of steam engines or hydraulic machines:—Mix boiled linseed oil, litharge, red and white lead together, to a proper consistence, always using the larger proportion of white lead. This composition may be applied to a piece of flannel and fitted to the joint. Cisterns built of large square stones, and put together with this cement will never leak. A more powerful cement for withstanding the action of steam, composed in the proportion of two ounces of sal ammoniac, and four ounces of sulphur, made into a stiff paste with a little water. When the cement is wanted for use, dissolve a portion of the paste in water rendered slightly acid, and add a quantity of iron turnings or filings, sifted or pounded, to render the particles of uniform size. This mixture, put into the interstices of iron work, will, in a short time, become as hard as stone. From experience, it is ascertained that more depends upon caulking the joints than in mixing the cement.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Institution.* Finsbury Circus.—Monday, April 3, at 1 o'clock, afternoon, R. Bond, esq., on Physical Geography.—Thursday, April 6, at seven, H. J. Gauntlett, esq., on Ecclesiastical Music.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, April 5, at half-past eight, Dr. Grant, on the Molluscous Classes of Animals.—Friday, 7, Mr. Foggo, on Taste in Literature and the Arts.

*Aldersgate-street Institution*—Wednesday, April 5, at eight, H. Goadly, esq., on the Anatomy of Insects, illustrated by the oxyhydrogen microscope.

*Islington Literary and Scientific Society.*—Thursday, April 6, at eight, G. F. Serjeant, esq., on the Political, Moral, and Religious, state of Spain.

*Bermondsey Mutual Instruction Society.*—Monday, April 3, at quarter past eight, Mr. Gregory, on Botany.

*Mutual Instruction Society*, 16 Great Tower-street.—Monday, April 3, at eight o'clock, Mr. Robinson's Introductory Lecture on Chemistry.

### QUERY.

LOGARITHMS.—Can you inform me of some of the latest works upon this subject?—R. W.

[Babbage's Table of Logarithms of Numbers, royal 8vo., 10s., coloured, 12s. Babbage's Table of Logarithmic Sines, &c., 8vo., 15s. Babbage's Sines and Tangents to do., royal 8vo., 12s.—ED. P. M.]

### TO CORRESPONDENTS.

"John Gregory." We are gratified to learn that our notices of his inventions have been the means of introducing him to gentlemen who have been of service to him. 2. Address "To the Lords of the Admiralty." 3. We think the machine should be made of full size. 4. "The Rotary Pump" shortly.

"Snubby Gong." The name was mistaken by the compositor. We do not, however, suppose that there are any *classical* associations connected with it, and therefore that the alteration is of very great importance.

"A Constant Reader." The terms of subscription to the Western Literary and Scientific Institution are two guineas per annum, with 10s. 6d. admission fee.

"A Reynolds." The paper and drawings of the "Velocipede," or Dandy Horse, shall be attended to.

Received "A. C. R.," "M. M.," "A Mechanic," and "N. S. N."

"A Lover of Science." There is a good deal of misunderstanding about the word, and we and our Correspondent certainly attach different ideas to it.

Books for review, and communications for the Editor, to be left, addressed to him, at the Publisher's.

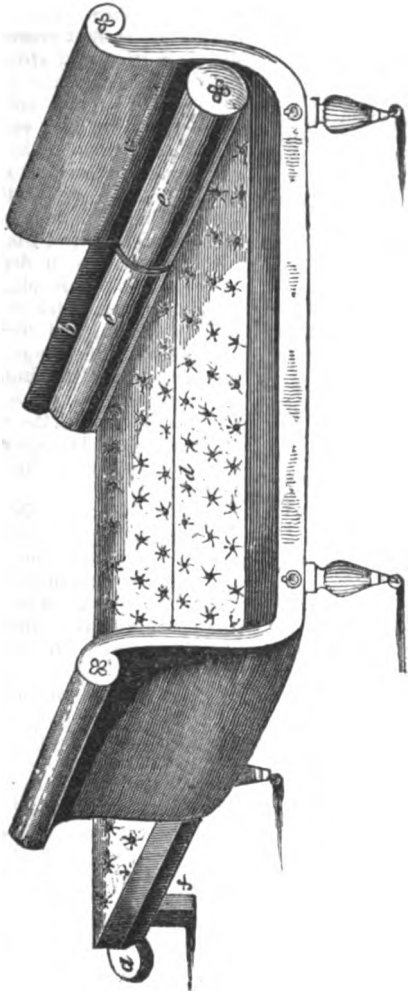
London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC.

## A MAGAZINE OF ARTS AND SCIENCES.

No. XXIV.] SATURDAY, APRIL 8, 1837. Vol. I.



F. MONDAY'S SOFA BEDSTEAD.

Vol. I.—No. XXIV. Holloway Press: D. A. Doudney.

Digitized by Google

*To the Editor of the Penny Mechanic.*

Sir,—The following is a description of a Sofa Bedstead, which you will perhaps think worthy of a place in your valuable Magazine. *a*, the back, hinged, to let down to form the bedstead; *b*, a thin headboard, made to slide in a groove in the direction of the dotted lines *c*, which must be fastened to the back with an hook and eye; *f*, one of the *three* feet, to support the back; *d*, the mattress, which is made to fold to form the cushion for the sofa; *ee*, the pillows of the sofa, to form the bolster for the bed; *h*, the back rail; *i*, one of the feet, made with a joint, the same as a common bedstead, which is kept in its position when open by an hook and eye; *k*, another of the feet, shut in the rail, the same hook serving as a fastening.

Your obedient Servant,

F. Monday.

London, March 6, 1837.

## MANUFACTURES.

### NEEDLE MAKING.

We intend, from time to time, to publish short descriptions under this title, of the manner in which our various domestic implements are manufactured, and also to make more generally known many processes connected with the arts that we think will be entertaining and instructive to our readers. A poet has said,

"To know
That which before us lies in daily life
Is the true wisdom."

And certainly the time employed in making ourselves acquainted with the history of instruments we are using every day, or of processes that we are constantly practising, will not be time misspent.

We have no reason for adopting any particular order for these papers, and have therefore taken for the first the manufacture of needles, both because it is a subject on which most of our readers will feel some interest, and also because Mr. Donavan, in his Treatise on Manufactures in Iron and Steel, has given so full and excellent a description of the process, that we can depend on him for our materials.

"English chroniclers record that 'the making of Spanish needles (as the fine sewing-needles were formerly designated) was first taught in Englande by Elias Crowse, a Germaine, about the eighth yeere of Queene Elizabeth; and in Queen Marie's time there was a negro made fine Spanish needles in Cheapside, but would never teach his art to any.'

"Although at present the needle trade in this country is not by any means so localised as might be supposed, the places most noted for the manufacture are, Whitechapel, in London; Redditch, in Gloucestershire; and Hathersage, in Derbyshire.

"The first process in needle making is *cutting and straitening the wire.*—A coil of soft, clean steel wire is cut with a pair of large shears, into lengths of four or five inches; each piece of wire will make, when again cut, more or fewer needles according to the size intended. These lengths are then bundled together by being bound round as compactly as possible by two iron hoops or rings about four inches in diameter; in this state the bundle is placed upon a cast-iron table, and a slab of iron about two feet in length, and broad enough just to fall between the rings, is placed upon the wires, and the bundle rolled backward and forward, the workmen pressing with the lever until the wires become perfectly straight. This operation, which is called rubbing, straightens the lengths perfectly.

"*Pointing.*—Needles of all sorts are pointed upon small grindstones running dry; between one and two dozens of the lengths just mentioned being applied at once with great dexterity by the grinder, each wire revolving while in contact with the stone. In consequence of the minute particles of steel which are evolved in a cloud during this operation, and which are necessarily inhaled by the workmen, needle grinding is found to be an employment extremely prejudicial to health. Of late years, however, various devices have been adopted for diminishing the evil, such as hanging a cloth over the stone, so as to draw off the greater part of the pulverulent atmosphere, wearing damped gauze over the mouth, or by placing a mask of magnetic gauze before the face, so that the floating metallic particles are arrested and detained; the needle pointers, however, like the fork grinders, who suffer dreadfully, and often fatally, from the same evil, manifestly exhibit rather a reluctance than a forwardness to adopt any pre-

Digitized by Google

ventative which seems to be an incumbrance, and which they oddly enough fancy might tend to abridge the amount of their earnings in the ratio that it should diminish the deleterious nature of their occupation. 'Because,' say they, 'if our work were less injurious, our masters would reduce the price of grinding.' The wire, when pointed, is again cut with shears into bits of the exact length of the intended needle.

"*Eyeing and Filing.*—To perforate a bit of exceedingly fine steel wire, so as to produce the eye in a needle hardly the thickness of a hair, must obviously require a hand possessing at once considerable delicacy and dexterity combined. The person, generally a female, performing this operation, first slightly flattens with a small hammer that end of the needle intended to receive the eye; she then places it upon a little anvil which is fixed in her work-bench, and by means of a stroke with her hammer upon a delicately-pointed steel punch makes an indentation on one side; she then places it upon a block of lead, and by a similar stroke with the same instrument completes the perforation. The needle is in the next place detained in a pair of pliers, and the head being bent back a little, it is, by means of a suitable kind of file, made to receive that peculiar channel or gutter which is observable on each side of the eye; this guttering, as it is called, is performed with amazing precision and dispatch by some women: a smooth file is afterwards applied upon the head of the needle. These processes are generally conducted by outworkers—women and girls at their own homes, and are mostly confined to the more delicate articles. The larger needles are brought more directly under the operation of machinery. For instance, the formation of the gutters and the piercing of the eye, are made to depend upon strokes given by a stamp and a fly press. In the former process, a piece of wire of the length of two needles, and pointed at both ends, is placed exactly in the middle upon a steel die having the form of a gutter, &c. impressed on its surface: over this die hangs another, its exact counterpart; so that by means of a blow from the stamp hammer, the two needles between the dies are exactly impressed on both sides with the channels already mentioned. The piece of pointed wire is then in a similar manner placed under a fly press, where, by means of two steel points falling over corresponding holes in a die, the two eyes are instantly pierced with great precision. These needles are then broken asunder, and the heads corrected with the file, as in the former case.

"*Soft Straightening.* — During the foregoing operations the needles have severally become more or less crooked, especially in the guttering by hand, when the head is pushed or bent backward and forward for the convenience of the file. To correct this defect, the needles are placed in files on a smooth metal plate, and by means of a piece of smooth iron, like that above described, they are rolled until they become severally quite straight.

"*Hardening and Tempering.*—The needles are placed, several thousands together, in a cast iron receptacle; and, after being covered over with ashes, to prevent oxydisation, they are submitted to the heat of a close furnace, until reaching a cherry red, the vessel is withdrawn, and its contents dropped into a tub of cold water; they are then collected from the water and placed upon an iron plate, kept nearly red-hot by means of a fire underneath. Upon this plate the workman, by means of two little iron shovels, keeps turning the lot of needles inside out, as it were, so as to allow the effect of the heat to take place upon them all equally. As soon as the blue oxydisation makes its appearance the needles are considered of the proper temper, when they are instantly removed, with singular dexterity, by means of the two spatulæ just mentioned.

"*Hard Straightening.*—As almost all kinds of steel articles, if light and slender, are found to suffer some alteration of shape during the process of hardening, so needles, in this stage, are more or less warped or bent; they are severally, therefore, straightened by means of two or three strokes from a small hammer on a little anvil fixed in the work-board for this purpose. They are now ready for

"*Scouring.*—This operation, requiring considerable force, is in all cases performed by water or steam power. The needles are placed neatly one over the

Digitized by Google

other, many tiers deep, and in parallel rows, upon a piece of stout coarse cloth smeared over with oil, soft soap, and fine flour emery; the cloth is then rolled up, so as to enclose the needles, much in the same way as certain Yorkshire housewives are in the habit of interlaying preserved fruit in lamina of paste for family dumplings: the rouleau is now tied about firmly, throughout its length, with strings. In this state several rolls, each containing 40,000 or 50,000 needles, are placed in a machine, exactly resembling an ordinary mangle, *i. e.* upon a board, over which is made to move backward and forward, by means of a crank, and making ten or twelve movements in a minute, a weighted box of an oblong shape. In this manner the needles are rolled one against the other, amidst the emery, for from two to three days; two or three wrappers being completely worn out, and the needles transferred to others, during that time. Out of the last of these wrappers they come perfectly clean and bright.

## RESULTS OF MACHINERY.

*To the Editor of the Penny Mechanic.*

Sir,—I am heartily glad that the letter I addressed to you some short time since upon this subject, has had the effect of drawing forth a champion of the opinion that the introduction of machinery has not been more injurious than otherwise to the *working classes*, because we can now ascertain what are really the opinions of the persons he represents. I am glad "J. B." has been kind enough to state his views upon the question, but I am sorry he has come to a conclusion so plainly contradicted, I think, even by his own letter. He states two propositions; first, that machinery has increased, not diminished the demand for labour; secondly, that machinery by lessening the cost of production of most of the necessaries and many of the luxuries of life, has greatly increased the means of enjoyment of the people—ego! machinery has been more beneficial than otherwise to the working classes. Now, without attempting to answer either of these propositions, without in the least degree questioning their accuracy, I submit that the statements contained in my letter remain unshaken. I still maintain that whenever a machine is introduced into any art or manufacture, it deprives the workmen who had previously been engaged in such employment of their means of subsistence, and therefore, although it may cheapen, as it undoubtedly does, many of the conveniences and comforts of life, yet as it lowers the wages of the workmen, it deprives them of the means of enjoying the advantages it bestows. Whether I state the case truly or not, let the hand-loom weavers, and the other classes of workmen who have been thrown out of employ by the introduction of machinery—let them answer. It appears that even your correspondent himself could not completely shut his eyes upon "what is really the state of the case," for he says no one ever denied that the introduction of machinery injured particular trades. What more, then, is wanting to prove my statement? What more is necessary to show the invariable tendency—the invariable result of machinery? J. B. would wish it to be thought that only a few persons in any particular trade are injured. He says, "Compare the number of hand-loom weavers and others who have been injured, with those who have been benefitted by machinery, and the injured will be seen to be exceptions to the rule." This is merely an assertion, it is not supported by any kind of proof; on the contrary, we have parliamentary reports, as well as individual experience, which tend to a conclusion directly opposite. If therefore your correspondent thinks he has answered my proposition, I must beg him to peruse my letter again, and he will then see that in order to do so he must show that machinery has not deprived workmen of their employment—has not lessened their rate of wages—and has not therefore been productive of misery to a very great majority of the working classes. When he does this I will willingly admit that the case is very different to what I at present believe and have affirmed. But till he does this my proposition remains unanswered.

I am anxious that the view I take on this matter should be placed beyond dispute, because, if I am correct, it is evident that a tax should be imposed on machinery for the benefit of the working man, or some other effectual means adopted, to prevent the destitution and misery to which *he* is now subjected, whenever machinery interferes to deprive him of his means of subsistence.

Yours, most obediently,

S.

27th March, 1837.

Digitized by Google

*To the Editor of the Penny Mechanic.*

Sir,—I beg to state to your correspondent, Mr. Rough, that spirits of wine boil several degrees below 212°, which is the heat of boiling water, so that it is obvious that spirit could not be preserved in the manner described page 164, as the case containing the spirits would burst long before the water boiled. If your correspondent wishes for a demonstration of this, let him put a little spirits of wine in a phial, and hold it in water; let him then make the water boil, and he will soon find that the water will boil long before it.

J. R. Hatts, M. D.

## A PLAN FOR EXTINQUISHING FIRES ON BOARD SHIPS.

The instrument alluded to, for the purpose of admitting water into a ship, is formed on the principle of the syphon. A bent copper tube, one foot in diameter, is placed through a port, having one arm outside the ship extending to a small depth below the water's surface; the other inside, passing through the gun-deck and orlop, to the lower part of the hold. Let the instrument thus placed, be supposed filled with water, and the two orifices closed; if they be then unclosed, the water will flow out at the orifice inside the ship, which is at a considerable depth below the water's surface, whilst the pressure of the atmosphere, forcing the fluid through the tube from the outside, will cause a constant stream to be maintained as long as may be required. Two valves are fitted closely over the orifices, which may be opened or shut by rods fixed to them, and brought up to the part of the instrument which rests on the portsill. These valves are for the purpose of more conveniently filling the instrument; and, by their means, its action may be made to commence or cease at any instant. It will be further necessary to immerse the orifice in the hold, a few inches, in a vessel of water, to prevent the admission of any particles of air, which may otherwise penetrate into the tube, at this place, in so considerable a degree, as eventually to stop its action.

It is suggested that an instrument of the kind be supplied to all ships. If, in ordinary, it be fixed in the above position, and filled with water (the valve inside the ship being shut, and that outside open, and secured back), this precaution will cause whatever leakage takes place at the inner valve to be supplied, and, at the same time, furnish a constant test to ascertain the state of the instrument. On discovering a fire to have commenced, the person on board has only to open the valve in the hold, by means of the rod brought up to the portsill, when the instrument will instantly be in full action. The adjoining ships, in the mean time, should send their syphons in their boats, and dispose them as quickly as possible through any port the fire will permit; for which purpose, every facility may be afforded in the disposition of the spaces left in the decks for the circulation of air. Thus the ship may be rapidly sunk to her portsills; the syphons then stopped, by closing the outer valves: and thus all the difficulty and expense of raising the bottom will be avoided.

Whilst the ship is being sunk, it will be necessary to plug up those holes with which some of the planks in the buttocks are usually perforated, for the admission of air; at the same time, the gun-deck scuppers must be also plugged, and the gun-room ports and air scuttles in frigates caulked.

It is presumed, the above instrument may be admitted to combine the following advantages:—

1. Simplicity; including the trifling expense of its construction, and the great improbability of its getting out of order.

2. The facility with which it is put in operation, and the continuance of its action without manual labour.

3. The power possessed of stopping its action at an instant; by which means, the expense of raising a ship in harbour is saved, and a security afforded against the effects of accident.

It is further proposed, that a few alterations be made in the orlops of ships of the line, and lower decks of other ships, so as to render these decks capable of being entirely covered with water. Another syphon, with its inner orifice just above these decks, must be also supplied, for the purpose of admitting the water, in the event of fire. With these arrangements, on an alarm of fire, the orlop or lower deck

Digitized by Google

may be immediately converted into a reservoir of water, which it is conceived will interpose a complete barrier to prevent the communication of the flames from the hold to the upper works, or from the upper works to the hold. On this supposition, if the fire should have commenced in the hold, by thus preventing it from extending upwards, whilst the hold is being rapidly filled with water, it will be shortly extinguished, with the loss of the works in the hold alone. The importance of this is considerable, even in ships in ordinary; but how greatly is it increased in ships at sea, if it is considered that those fires, which are usually most fatal, might be thus, with great probability, extinguished, and the loss of many valuable lives prevented.

Supposing the fire to have commenced on the decks of a ship in ordinary, she may be sunk till the gun-deck is below the water's surface, and covered with water; when the syphons should be stopped, taking care to plug up the scuppers. Thus the whole of the ship below the gun-deck sills may be preserved, whilst the usual means are resorted to for saving the top-sides.

In a ship at sea, under the above circumstances, the crew should take to the boats and spars, and, whilst the ship is being sunk by the syphons, exert every possible means to preserve the gun-deck till it is sunk below the water's surface, and covered as described above. This deck, when the fire shall have burnt out, will answer the purpose of a raft; and if the pumps are uninjured (for which purpose every thing connected with them should be of metal), the crew may be able to get to the provisions, and in favourable weather may, perhaps, in many instances, be saved.

The alterations necessary, in the orlops and lower decks of frigates, must be now considered. In frigates and small vessels, nothing further will be necessary, than to have the comings round the hatchways and mast-partners of sufficient height. On the orlop decks of ships of the line, besides the height of the comings, a cant must be fixed at the after part, to prevent the water from flowing into the bread room; the wing gratings substituted by solid scuttles, and perhaps the plank under the cable tier may be hal an inch thicker, to allow of its being caulked. Ships in ordinary will also require cants to be fixed round those spaces left in the decks for the admission of air. It is presumed, the expense and inconvenience produced by these alterations would be inconsiderable.

It would be very advantageous to have, at least, two athwart-ship bulkhead caulked with penstocks in the limbers, capable of being screwed down from the gun-deck; by which, a fire below would be extinguished much more rapidly, and with much less injury to the provisions and stores.

The hold of a three-decked ship in ordinary, it is considered, may be filled by sinking her not more than 5 feet 10 inches. This space will diminish with the class of ship: in a ten-gun brig, not more than 2 feet 3 inches will be requisite. It is manifest how considerably it will be diminished when the stores and provisions are stowed. A 74-gun ship, in ordinary, will require about 1,300, tons of sea-water to fill her hold; and, supposing her fitted with a syphon of each kind above described, this may be accomplished in less than two hours.

## PERPETUAL MOTION.

*To the Editor of the Penny Mechanic.*

Sir,—In Number 23 of your most valuable work, your correspondent "Brack's Brother," takes rather a difficult task upon himself to prove the fallacy of my Perpetual Motion which appeared in Number 20. He says it would not move at all; but I suppose he will allow one to know who has proved it with success. The two springs are not to be of equal strength, and the fly-wheel goes very far; so therefore my plan you will find is quite correct. I should be much obliged to "Brack's Brother," to form a model and try the experiment, as I have myself done.

Yours, truly,
J. W. Ritchie, Junior.

April 4, 1837.

Digitized by Google

## MECHANICS' LIBRARY.

*The Producing Man's Companion—State of Society in England. By Junius Redivivus.* Effing. Wilson.

We have seldom perused a book with greater satisfaction than this. Unlike many works that are written for the purpose of instructing those who are condescendingly spoken of as the "poorer classes," the one before us is written in a manly, generous spirit, as a man should write who wishes to make the knowledge he is possessed of useful to others, without rendering its acceptance in any way humilitating. Such unfortunately is not the style always adopted by those who write works similar to the "Producing Man's Companion;" but "Junius Redivivus" is a sincere friend of the working man, and he has addressed him as such. The volume contains a very lucid exposition of the principles of Political Economy, more particularly as they affect the well-being of the working classes. After considering the present condition of society, and the numerous evils, both social and political, under which this class of society at present labours, he points out, at some length, the best means he can suggest for remedying the evil. There can be no doubt that the remedy must be obtained —must be proposed and carried into practice by the working classes *themselves;* and, when we consider what they have already accomplished, we look forward with a pleasing certainty that the time will arrive when the desirable object shall be obtained. Junius Redivivus maintains the opinion that an over population exists—that the number of consumers is greater than the supply of food, and that consequently some must starve, or a great number be obliged to submit to receive an insufficient quantity of food, in order to prevent such an occurrence. This is the case at the present time.

"The lover of his species will lament over this horrible reality, and ask, if it must go on for ever—if there are no means of preventing so much misery? The answer is, yes; education will remedy all; —not that which is commonly called education, the mere tools of knowledge—reading and writing; but the development of the reasoning power which all human beings possess in a greater or less degree; the bringing forth of mind, and teaching it the exercise of thinking. Shallow persons cry out against education, as tending to unfit human beings for the laborious and drudging duties of life. More interested persons cry out against education, because it is the means of bringing forth latent intellect, which will push them from their stores of idleness, and force them to fresh exertions, in order to retain their places as men in authority: for they well understand the axiom of Bacon, that "knowledge is power," and the highest degree of knowledge must reign paramount; so that, were all educated, the present factitious state of the authority of *caste* could not endure. This they know, and as they wish to perpetuate the present state of things, they cry out against education. But such persons as these are prejudiced judges, whom no reasoning could convince, which tends to the overthrow of their selfish interests; therefore, they are not worth notice. But those who really believe that education is mischievous in practice, and tends to unfit poor people for the discharge of their duties, would do well to reflect, that the perpetrators of arsons and other outrages, during a state of public excitement, have been the miserable pauper peasantry—the people without education. It is ignorance alone which resorts to violence; because ignorance, not being able to reason from cause to effect, resorts to blind destruction. What was it which produced the difference between the first and the second French revolution? Why did the population of Paris in the eighteenth century delight in butchery, and in the nineteenth shine forth a race of heroes, brilliant with exalted courage, and at the same time exercising the sublimest traits of mercy and forbearance? The mists of ignorance were expelled by the accumulated knowledge of forty years, gained in the school of experience. That was really education."

And Junius Redivivus considers that, in process of time, if means are taken to improve the mental condition of the people, that as great and beneficial a change will be effected in the minds of the people of this country.

The book is not new, but it is one that we are sure will benefit every person who reads it, whether he agrees or disagrees with the conclusions of the writer. It is written in a vigorous, manly style, very much resembling Cobbett's, and the language used is always appropriate.

---

We are informed by a Correspondent that the London and Birmingham Railway will be opened, for a distance of one-and-twenty miles, on the 1st of June next. We wish the promoters of this grand national undertaking every success.

Digitized by Google

## MISCELLANIES.

*The Lunar Eclipse* on the 30th instant, is likely to be attended by an extraordinary and interesting occurrence. The Eclipse will begin at half-past six o'clock in the evening, and the moon will rise eclipsed at seven o'clock. As the earth must be between the sun and the moon, in order to occasion an eclipse, the sun ought then to be below the horizon; but owing to the refraction of the atmosphere, it is conceived that we shall see the singular phenomenon of the sun remaining *above* the western horizon, while the moon appears eclipsed in the eastern. Such a phenomenon was seen in Paris in 1750.

*Straw Weaving.*—A new manufacture has been introduced into the west of Scotland—the weaving of straw hats. The straw instead of being plaited by the hand, is woven by the loom; the warp employed being a slender thread of silk, which unites the straw firmly together, and produces a very beautiful fabric. It is woven in pieces of twelve yards long, and an inch broad; the one edge exhibiting an ornamental pattern susceptible of infinite variety, and when sewed together and made up into bonnets, the appearance of the whole is extremely pretty, and the cost will not exceed one half of that of tuscan.

*Sting of Bees, Wasps, and other Insects.*—These are seldom fatal; but the pain which they excite is almost insupportable in some habits. Let the affected parts be bathed with tepid spirit of Mindererus.

## INSTITUTIONS.

*Popular Education Association.*—We are happy to have it in our power to direct our readers attention to this association, which we are sure only requires to become more generally known, in order to render it of much service to the cause of popular education. Its objects are to form a collection of diagrams, and apparatus to illustrate scientific lectures; and to provide *Gratuitous* Lecturers to Mechanics' Institutions, and similar associations that may require such assistance. The diagrams, &c. are also furnished to lecturers without any charge. The association has only been established a few months, but already it has been the means of forming several societies and has assisted many others.

### LECTURES DURING THE WEEK.

*London Institution.* Finsbury Circus.—Monday, April 10, at 1 o'clock, afternoon, R. Bond, esq., on Physical Geography.—Thursday, April 13, at seven, H. J. Gauntlett, esq., on Ecclesiastical Music.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, April 12, at half-past eight, Dr. Grant, on the Molluscous Classes of Animals.—Friday, 14, Dr. Ritchie, on Optical Instruments; Double Refraction; and Polarization of Light.

*Eastern Athenæum*, Stepney Square.—Wednesday, April 12, Mr. Deville, on Phrenology, at eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, April 13, at eight, C. Buckingham, esq., M. P., on Palestine.

*Southwark Literary Society.*—Wednesday, April 12, W. Lucking, esq., on Fossil Organic Remains, at eight.

*Islington Literary and Scientific Society.*—Thursday, April 13, at eight, Mr. T. Cromwell, on the Archeology of the British Islands.

*Mutual Instruction Society*, 16, Great Tower-street.—Monday, April 10, at eight o'clock, Mr. Robinson, on Phrenology.

*Bermondsey Mutual Instruction Society.*—Monday, April 10, at quarter past eight, Mr. Gregory, on Botany.

*Finsbury Mutual Instruction Society.*—Tuesday, April 11, at half past eight, Mr. Logan, on Phrenology.

### QUERY.

Can any of your correspondents explain to me why, if the rays of the Sun are suffered to fall on a fire, they will put it out.

W. C. C.

### TO CORRESPONDENTS.

"A. C. R.," who proposes to create a perpetual motion by magnetism, has not stated in what way he supposed this can be effected. The magnetic fluid can only be generated for a certain time without a supply of acid, &c.

We should be glad to receive a fuller description of the Rotary Pump, sent us by "J. G." also, of its mode of working.

"Mr. Reynolds's" request shall be complied with.

"The Method of describing an Oval" *is* worthy a place in the Magazine, but would not, we think, interest the majority of our readers.

"Anthony Morton's" letter on the Results of Machinery, shall be attended to.

Received, "J. W. Ritchie,"—"No Chemist,"—"F. P. C."

If the Secretaries of Institutions will forward us admission tickets for their Quarterly or General Meetings, we will attend and report the proceedings.

Books for review, and communications for the Editor, to be left, addressed to him, at the Publisher's.

ERRATA—Steam Boilers in last No.: for "fill," line 29, read "feed;" for "marked," line 65, read "worked;" for "65," line 74, read "85."

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. XXV.] SATURDAY, APRIL 15, 1837. Vol. I.

RAILWAYS.
Fig. 1.

Fig. 4.

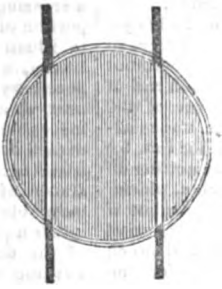


Fig. 3.

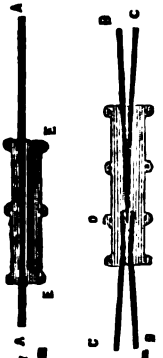



Fig. 2.

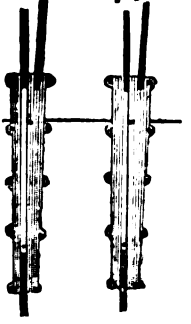


Fig. 7.

Fig. 8.

Fig. 6.

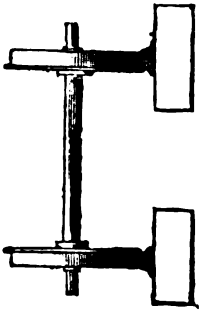


Fig. 5.

Holloway Press: D. A. Doudney.

Digitized by Google

## RAILWAYS.

NO. IV.

AN iron railway is constructed by placing straight bars of iron along its whole length, two of which being placed parallel to each other, form a track, on which the wheels travel; in most public lines, not less than two tracks are used, the one for going, and the other for returning. The wheels used for travelling upon railways, are coupled by means of the axletree, so that the one wheel cannot turn without the other. One wheel runs on each rail of the track, and if both wheels are of the same size, they will continue undeviatingly in a straight line, (Vide FIG. 6.) The wheels are prevented from getting off the track by means of the flanch *a*, placed on the inner edge of the wheel; but if this was to rub against the rails, great friction would be produced, and much power lost; to avoid this, therefore instead of the rim of the wheels being made cylindrical, they are made conical, with their smaller diameters placed outside, and the rails are placed about one inch further apart than the two flanches, now it will be seen by this, that if the flanch of one wheel should get close to one rail, that wheel will be travelling on a larger diameter, while the other will be travelling on a less than they would if each flanch was an equal distance from the rails they are travelling on; (both wheels being connected by means of the axletree) the consequence will be, that one wheel will travel further than the other, so that the axletree will be turned to less than a right angle with the road, (the angle it should always occupy), and thus throw the larger diameter of the other wheel, on the other rail, and thus adjust itself, so that the flanches should never touch the rails; another effect produced by the conicalness of the wheels, is this, it is evident that where there is a turning in the road, the cylindrical wheels would have a tendency to continue in a straight line, and thus get off the rails. Now where there is a curve in a railway, the outer rail will be longer than the inner one, and where a carriage goes round a curve, the centrifugal force, causes the carriages to fly towards the outer rail, which is raised, to counteract it in a measure, but not completely, for then the flanch of the outer wheel, is allowed to approach the outer rail sufficiently to establish a proportion between the difference of the length of the two rails, and the difference of the diameters of the two wheels, and in this case the flanches of the two wheels, seldom or never touch the rails.

It will appear from this, that the carriages on a railroad, will continue in the same track from one end to the other; but it is sometimes necessary to turn the carriages out of one track into another, either that one part of the road may be repaired, or to pass another train going at a different velocity; for this purpose, a crossing is made use of. In FIG. 1, a portion of a railway is shown on purpose to illustrate it; A B represents the two tracks, and suppose a carriage at A, was necessary to be passed into the track B, near A, a portion of each rail is made moveable on a pivot at one end, and connected at the other by means of a rod of iron (fig. 2). Now from the circumstance of a portion of these rails being moveable, they may be made to form either a part of the track A (fig. 1), or part of the diagonal track C, now a carriage wishing to pass from the track A, to the track B, would cause the moveable rails to form part of the track C, consequently, the carriage instead of continuing along the track A, will turn into the diagonal track C. It is necessary that the diagonal track should be exactly in the same plane as the other two; and it will be seen that the two inner rails of the straight tracks, must be cut to let the flanches of the wheels through, at the places where the diagonal rails intersect them, which is represented in (fig. 3), where *a a* and *b b* represent the two rails of the straight tracks and *c c*, one of the rails of the diagonal tracks, the line *a a*, is not intersected in this case, but the two lines *b b* and *c c* do intersect each other, and therefore, the lines *b c*, meet in a point near *d*, while the lines *b c* only approach within a distance sufficient to allow a flanch of the wheel to pass on either side of the point formed by the other two lines, the short rail *e e* is placed to catch the flanch of the wheels, passing in the straight track, to prevent them getting off the rails at the opening of the crossing. It will be seen by (fig. 1), that to render a crossing complete, it is necessary to have a pair of moveable rollers at each end of the diagonal track, similar to (fig. 2), and two points as (fig. 3). The switches or moveable rails, are moved by means of a lever handle by an attendant of the road, whose duty it is to place them in the proper position according to given signals. In (fig. 1) the moveable rails are represented black, and are shown with one pair pointing into the main line, and the other into the diagonal; in fig. 2, the moveable lines, are represented white. Besides these

Digitized by Google

crossings, it is sometimes necessary to use a turning plate, as it is called, these are represented by two circles at the end of fig. 1, and enlarged in fig. 4; it consists of a round flat plate, fixed upon a verticle axis, across which are stretched the rails, they are only used in the depôts, or where it is necessary to turn a carriage round at right angles very sharply, then the carriage is drawn on to the plate, when carriage and plate are both turned round together. Fig. 5, represents a section of this contrivance, A represents the plate, with the rails affixed, B a cross throng, which the verticle spindle passes, C the pivot of the vertical spindle, the edges of the plate are supported all round by means of friction rollers D; now it will be seen, that it would take a considerable time to pass a train over a turning plate, therefore, they are never used, where one railway joins another, even at right angles, but the adjoining railway is made with a curve at its end, when it enters the tracks of the other rails by means of a pair of moveable switches, similar to fig. 2.

Figs. 7 and 8, represent sections of the rails with their chairs, these rails are rolled, with an uniform section throughout at the present time, but they used to be made, what is called fish-bellied, that is, they were made deeper in the middle, between the two supports, (similar to the belly of a fish) to give them greater strength; but that system is quite exploded, and they are now made of an uniform section. The rail fig 7, weighs 56 lbs. to the yard, *a* is the rail, *b* the chair, which is cast of the shape represented. The rail is dropped in, and a piece of wood *c*, is drove in at the side to hold it firm. Fig. 8, represents a rail 35 lbs. to the yard, but it is not adapted for engines passing over it at a rapid rate, it is formed with an uniform section, and is kept in its chair, by having a feather rolled upon one side, against which an iron key or wedge is pressed; *a* represents the rail, *b* the chair, and *c* the key or wedge, in each rail, the supports are placed 3 feet apart, and the axletrees of the carriages are never placed closer than 4 feet 6 inches, so that the wheels can never rest between the same two supports at the same time.

In these papers, it has not been my object to describe the various transitions which have taken place in the history of railroads, as that would be too tedious, but only to describe the form, in which they at this period exist; upon another occasion I will undertake to describe the Locomotive Engine, and other matters connected with this subject.

E. T. W.

## RESULTS OF MACHINERY.

*To the Editor of the* PENNY MECHANIC.

SIR,—The members of a society to which I belong are much interested in the discussions in your valuable periodical, headed Results of Machinery.—When a shower of rain falls upon a field, the owner thereof has an undoubted right to the benefit of it; so it ought to be with machinery—machinery falleth upon labour which is the prerogative of the working-classes; and they ought to receive the most benefit from it. I maintain that the working-classes have not received their fa r share of the benefits derived by the production and application of machinery. A correspondent in your 21st Number states, it is capital that employs human labour; it is the relative amount of capital and labour that determines the high or low rate of wages, and that this view is correct I think none will dispute. Upon the first part of I. B.'s correspondence I would offer a few remarks, he states that with the assistance of machinery a master tradesman or manufacturer is enabled to dispense with the labour of fifty of his workmen, and thereby save the amount of their wages, say £3,000 per annum, consequently he becomes a capitalist, and in most cases a landlord; and then by a curious argument I. B. attempts to show how the capitalist employs the money thus saved. A quick return is the mainspring of trade; but upon enquiry I. B. will find that the capitalists generally receive their rents half yearly, which are paid away only once during the half year, or lodged in the hands of the banker. Ah but, says I. B., the banker receives the money for the purpose of employing it in trade; granted, but the circulation of the £3,000 from the time it is taken from the working-classes, until it is again circulated amongst them, is not one twentieth part so rapid, as during the time it is in their possession. View it as we may, we find that the accumulating of money into large masses in the hands of the few, retards its circulation and injures trade. If our eyes were but piercing enough to see the rapidity with which the money passes from one to another amongst the working-classes, especially in large towns, how the shopkeepers and the poor are benefited by it, every time it is turned over, and the difference of good which the money does amongst them, to what it does in the hands of the rich, we should soon find out the cause of the distress of the poor, and say, more money ought to be conveyed from the higher classes to the lower. It very often happens that the working-classes do

Digitized by Google

not keep their money by them more than one day; it is usual for them to receive their money on a Saturday night, and lay out almost all of it the same night; they pay it to the shopkeepers and others, and turn it into a quick and rapid current, which benefits them and trade generally by the number of times that it passes from one to another; but it is soon taken up again by the tenents of houses, farmers, &c., and paid into the hands of the capitalist again, were it lays completely out of the reach of the working-classes and trade for a long time. A great deal of attention has been paid to increase the supply, but very little in proportion to get the demand for labour; many machines have been invented, so as to ensure a very large supply of goods, and many men have been employed to make these machines; now we are almost set fast for want of the demand. As the supply increases, the demand decreases, as machinery increases, it diminishes the wages of the workmen, which prevents them from giving their share of the demand. Machinery at present is only in its infancy, it is as land uncultivated, it is not yet brought into that pure use for which it is intended; it may be termed a wild and savage animal, with but one eye; and that is directed to his master; but on the other sidé it turns round upon the men and gets them down, and if it does not worry them, it binds them in chains so as to disqualify them from rendering any essential service to the country, to trade, or to their masters. Their masters begin to find that something is the matter, but appear not to know what it is; from time to time they complain trade is bad, but seem to be ignorant of the cause; they do not understand that they are in need of the suffering workmen, to give a sufficient demand for their manufacture. It is only a just punishment for their sins, in defrauding the poor of the benefit of their industry, to which they have an unquestionable and just right.

Let those who wish to do essential good to their country, endeavour to shorten the time which money stops in the hands of the higher classes of society. This would be striking at the very root of the evil under which the nation groans. I will conclude with the words of Mr. George Combe. The first step towards the improvement of the great mass of the people must be to reduce the hours of labour, and to dedicate a portion of time daily to the improvement of the mental faculties.

Yours Respectfully,

ANTHONY MORTON.

## BIOGRAPHICAL NOTICES.

### CARTWRIGHT.

ONE of the most striking instances of the benefit society has derived from the introduction of machinery, is the very low price at which our common articles of dress can now be purchased, compared with their price when they were all manufactured by hand. A servant maid in the present day can afford to dress herself more handsomely than persons in a far higher station in society at the commencement of the last century. Indeed, the people, by which we mean the great body of the middle and working classes, have benefited much more by the change than the higher class of society has, because the articles of dress that have been reduced so much in price, are those that are more required by the former classes than by the latter. We allude more particularly to the woollen and cotton manufactures. We gave an acconnt, a Number or two back, of the astonishing increase that had taken place in the demand for cotton goods, and also how greatly their price had been reduced. This national blessing, for such it is, since nearly every class of society is enabled to procure comfortable decent clothing, is mainly attributable to the excellent man of whom we are about to give a short notice. His biography affords a memorable example of what may be done by perseverance; and "the Pursuit of Knowledge under Difficulties," to which we are indebted for our materials for this sketch, does not afford a brighter instance of the utility of that "little learning" that is so much dreaded by some persons and despised by others.

Edmund Cartwright was born in the year 1743, and was the fourth son of William Cartwright, Esq. of Marnham, in Nottinghamshire. One of his elder brothers was the late Major John Cartwright, so well known for his steady devotion through a long life to what he believed to be the cause of truth and patriotism, and for many public and private virtues which commanded the respect even of those who differed most widely from him in politics. Being intended for the church, Edmund at the usual age was entered on University College, Oxford, from whence he was subsequently elected a Fellow of Magdalen College. He early distinguished himself by his literary attainments, an evidence of which he gave to the world while yet a young man by the publication of a small volume of Poems, which was

Digitized by Google

very favourably received. About the year 1774, also, he became a contributor to the Monthly Review; for which he continued to write during the following ten years.

For the first forty years of his life he had never given any attention to the subject of mechanics; although, as was recollected long afterwards, his genius for invention in that department had once displayed itself, while at his father's house during one of his college vacations, in some improvements which he made on an agricultural machine which happened to attract his notice. But this exercise of his ingenuity, being out of the line of his pursuits at that time, led to no other attempt of the kind, nor to any further application of his thoughts to such matters. The circumstances which many years after this led him to the invention of his weaving machine, or power-loom, as it is commonly called, cannot be better described than they have been by himself in the following statement,—first printed in the Supplement to the Encyclopædia Britannica. "Happening," he says, "to be at Matlock in the Summer of 1784, I fell in company with some gentlemen of Manchester, when the conversation turned on Arkwright's spinning-machinery. One of the company observed that as soon as Arkwright's patent expired, so many mills would be erected, and so much cotton spun, that hands would never be found to weave it. To this observation I replied, that Arkwright must then set his wits to work to invent a weaving-mill. This brought on a conversation upon the subject, in which the Manchester gentlemen unanimously agreed that the thing was impracticable; and in defence of their opinion they adduced arguments which I was certainly incompetent to answer, or even to comprehend, being totally ignorant of the subject, having never at the time seen a person weave. I controverted, however, the impracticability of the thing by remarking that there had been lately exhibited in London an automaton figure which played at chess. Now you will not assert, gentlemen, said I, that it is more difficult to construct a machine that shall weave, than one that shall make all the variety of moves that are required in that complicated game. Some time afterwards a particular circumstance recalling this conversation to my mind, it struck me that, as in plain weaving, according to the conception I then had of the business, there could be only three movements, which were to follow each other in succession, there could be little difficulty in producing and repeating them. Full of these ideas, I immediately employed a carpenter and smith to carry them into effect. As soon as the machine was finished, I got a weaver to put in the warp, which was of such materials as sail-cloth is usually made of. To my great delight a piece of cloth, such as it was, was the produce. As I had never before turned my thoughts to mechanism, either in theory or practice, nor had seen a loom at work, nor knew anything of its construction, you will readily suppose that my first loom must have been a most rude piece of machinery. The warp was laid perpendicularly, the reed fell with a force of at least half a hundred weight, and the springs which threw the shuttle were strong enough to have thrown a Congreve rocket. In short, it required the strength of two powerful men to work the machine, at a slow rate, and only for a short time. Conceiving in my simplicity that I had accomplished all that was required, I then secured what I thought a most valuable property by a patent 4th of April, 1785. This being done, I then condescended to see how other people wove; and you will guess my astonishment when I compared their easy modes of operation with mine. Availing myself, however, of what I then saw, I made a loom in its general principles nearly as they are now made. But it was not till the year 1787 that I completed my invention, when I took out my last weaving patent, August the 1st of that year."

Dr. Cartwright's children still remember often seeing their father about this time walking to and fro apparently in deep meditation, and occasionally throwing his arms from side to side; on which they used to be told that he was thinking of weaving and throwing the shuttle. From the moment indeed when his attention was first turned to the invention of the power-loom, mechanical contrivance became the grand occupying subject of his thoughts. With that sanguineness of disposition which seems to be almost a necessary part of the character of an inventor, he looked upon difficulties, when he met with them in any of his attempts, as only affording his genius an occasion for a more distinguished triumph; nor did he allow even repeated failures for a moment to dishearten him. Some time after he had brought his first loom to perfection, a manufacturer, who had called upon him to see it at work, after expressing his admiration of the ingenuity displayed in it, remarked that, wonderful as was Mr. Cartwright's mechanical skill, there was one thing that would effectually baffle him, namely, the weaving of patterns in

Digitized by Google

checks, or, in other words, the combining, in the same web, of a pattern, or fancy figure, with the crossing colours which constitute the check. Mr. Cartwright made no reply to this observation at the time; but some weeks after, on receiving a second visit from the same person, he had the pleasure of showing him a piece of muslin, of the description mentioned, beautifully executed by machinery. The man is said to have been so much astonished that he roundly declared his conviction that some agency more than human must have been called in to assist on the occasion.

After this Dr. Cartwright exercised his ingenuity in a variety of other contrivances; and introduced valuable improvements in the combing of wool by machinery, in rope-making, and in several other departments of agriculture and manufactures. For some of these inventions he took out patents, and for others premiums were bestowed upon him by the Society for the encouragement of Arts, and the Board of Agriculture. Even the steam-engine engaged his attention; and an account of some improvements which he proposed in its mechanism may be found in Rees's Cyclopædia. Indeed, so long as forty years ago, while residing at Eltham in Lincolnshire, he used frequently to tell his son that, if he lived to be a man, he would see both ships and land-carriages impelled by steam. It is also certain that at that early period he had constructed a model of a steam-engine attached to a barge, which he explained about the year 1793, in the presence of his family, to Robert Fulton, than a student of painting under his countryman West, and whose zeal and activity afterwards, as is well-known, brought the project of steam-navigation to such perfection in America, from whence it has extended all over the civilized world. Even so late as the year 1822, Dr. Cartwright, notwithstanding his very advanced age, and although his attention was much occupied by other philosophical speculations, was actively engaged in endeavouring to contrive a plan of propelling land-carriages by steam. His death, however, at Hastings, in October 1823, prevented the completion of this, as well as of many other designs in the prosecution of which he had been employed. His enthusiasm for mechanical invention continued unabated to the last; and indeed his general energy both of mind and body was very little impaired up to within a short period of his death.

# MANUFACTURES.

## NEEDLE MAKING.

NO. II.

*Heading and Picking*,—consists in placing all the heads one way, and all the points another—a manipulation performed by children with a degree of expertness only attainable by much practice—and likewise in picking out from the whole heap the broken eyes and broken points, which, as may well be supposed, are very numerous in consequence of the severe operation last described; the former, of course, are thrown aside as wasteless, the latter are generally repointed as blunts, and made up by themselves for sale.

The ingenious and profoundly scientific Mr. Babbage describes the last-mentioned operation with great distinctness, as exhibiting, in his opinion, one of the simplest contrivances that can with propriety be called a tool. The needles are placed sideways in a heap, on a table in front of the operator. From five to ten are rolled towards this person by the fore-finger of the left hand: this separates them a very small space from each other, and each in its turn is pushed lengthways to the right or to the left, according as its eye is on the right or the left hand. This is the usual process, and in it every needle passes individually under the finger of the operator. A small alteration expedites the process considerably: the child puts on the fore-finger of its right-hand a small cloth cap or finger-stall, and rolling from the heap from six to twelve needles, it keeps them down by the fore-finger of the left-hand; whilst it presses the fore-finger of the right-hand gently against the ends of the needles: those which have their points towards the right-hand stick into the finger-stall; and the child, removing the finger of the left-hand, allows the needles sticking into the cloth to be slightly raised, and then pushes them towards the left side. Those needles which had their eyes on the right-hand do not stick into the finger-cover, and are pushed to the heap, on the right side, previous to the repetition of the process. By means of this simple contrivance, each movement of the finger from one side to the other carries five or six needles to their proper heap; whereas, in the former method, frequently only one was moved, and rarely more than two or three were transported at one movement to their place.

As there are diversities of manufacture, every user of very fine needles must of late years have heard of gold-eyed, and silver-eyed, and drilled-eyed needles, each sort

Digitized by Google

equally "warranted not to cut the thread." It may be sufficient here to say, that the well-known appearance of the former is produced by dipping the head of the needle into the spirit of ether, containing a little gold in solution, and which immediately attaches itself to the steel, when dipped in the menstruum. Needles are sometimes treated with this ethereal solution of gold all over, in order to give them a beautiful yellow colour, and at the same time to prevent them from rusting. As to the second sort, not a particle of silver, or of any thing like it, is used, the peculiar white polish of the eye being communicated by means of its application to a little cylinder stuck full of steel pegs, like the small tune-barrel seen inside those musical boxes which are so common now-a-days. The drilled-eyes constitute a real improvement: not, indeed, that the eye itself is actually formed by drilling, any more than the silver-eyed needles owe any portion of their finish to that metal; but the eyes being countersunk, and smoothed on both sides by a drill after punching, they not only look well, but are when carefully made, little, if at all, liable to cut the thread. They, likewise, rarely break in the eye,—the common fault of common needles,—because they are not only made of the very best material, but being moreover blued or softened, to allow the drill to cut, they are not so brittle as otherwise they would be.

*Blue Pointing*,—or the communicating of that exquisite polish which all the best needles are seen to possess,—is performed by applying them, several together, to a revolving stone about the size and shape of one's finger: this stone is of a slaty-blue colour, and comes from Warwickshire. This is generally the finishing operation; after which the needles are made up in little packages of a quarter of a hundred, labelled, and wrapped up in larger parcels for sale. The cheapness of the commoner sort of needles has frequently been the theme of wonder, with those persons who have considered the variety of manipulations through which they must have passed on the other hand, needles of the most exquisite delicacy and finish exhibit one of the rarest proofs of the value conferred by manual labour upon a material in its original state of small nominal price; for some of the finest sorts are worth considerably more than their weight in gold.

## PERPETUAL MOTION.

*To the Editor of the Penny Mechanic.*

SIR,—The answer of your Correspondent J. W. Ritchie to my letter, inserted in the last Number but one of your Magazine, proving the fallacy of his plan of obtaining perpetual motion by means of springs, is still more absurd than before, he says now, the springs are not to be of equal power, but one of them must be stronger than the other. I can well understand that the stronger spring can set in motion the weaker one, but cannot for the life of me make out, how the weaker one can overcome the stronger! And I dont know what he means by saying that the "fly-wheel goes very far." I would with the greatest pleasure, make a model, and try the experiment myself, but I am not over-fond of throwing away time, trouble, and expense, upon a thing which when completed, I am confident would not succeed.

As to J. W. Ritchie's having made one himself, and proved it with success, I am very sure that is not the case, he might have made one certainly, but I am confident it did not succeed; and any person possessing the least grain of sense, must at once see the absurdity as well as the impossibility of such a proposition, it being decidedly against the *laws of Mechanics*.

You would do us both a very great favour, Mr. Editor, if you would have the goodness to state, at the end of this communication, whether J. W. Ritchie, is right or

Your most Obedient Servant.
BRACK'S BROTHER.

*** In Number 8, we have stated at length our opinion respecting the possibility of obtaining a perpetual motion. We do not suppose Mr. Ritchie thinks he can produce any thing of the kind, though the title of his communication might certainly bear that interpretation. With respect to his engine, it is evident that if both the springs are of equal power, the fly-wheel can only continue in motion for a short time, and then it will be stopped by friction; it will gain nothing from either of the springs. And if one of the springs is formed stronger than the other, the stronger will certainly prevent the other having any motion whatever. In either ease the machinery would only continue in motion while the impulse that first set the fly-wheel in action remained.—ED. P.M.

Digitized by Google

## RAILWAYS.

The number of proposed railways, including diversions, extensions, and branches, in England and Wales, for which plans have been lodged in the Private Bill Office in the present session, is seventy-five, of which only forty-eight are under the consideration of Parliament; these amount in length to twelve hundred and thirty-three miles, and are estimated at the sum of nineteen millions three hundred and fifty-two thousands seven hundred and twenty-six pounds, or fifteen thousand six hundred and ninety-five pounds per mile. The whole length of tunnelling is twenty-five miles; and the number of bridges, exclusive of viaducts and culverts, two thousand eight hundred and twenty-five, or nearly two and a third per mile. The weight of iron required for the rails, is one hundred and ninety-three thousand five hundred tons; and of stone for the blocks, two millions six hundred and seventy thousand tons. The area of land required to be taken is upwards of fifteen thousand acres; and of felt for the chairs, one hundred and thirty acres. These railways, if carried into execution, would employ at least five thousand men and fifteen hundred horses for three years, for the earthworks alone.—*Whishaw.*

# INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday, April 17, at 1 o'clock, afternoon, R. Bond, esq., on Physical Geography.—Thursday, April 20, at seven, H. J. Gauntlett, esq., on Ecclesiastical Music.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, April 19, at half-past eight, Mr. Cull, on Phrenology.—Friday, 21, Dr. Ritchie, on Optics, &c.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, April 20, at eight, C. Buckingham, esq., M.P., on Palestine.

*Eastern Athenæum*, Stepney Square.—Wednesday, April 19, at eight, Col. Thompson, M.P., on Free Trade.

*Southwark Literary Society.*—Wednesday, April 19, W. Lucking, esq., on Fossil Organic Remains, at eight.

*Lambeth Literary and Scientific Institution.*—Tuesday, April 18, at half-past eight, F. J. Searle, esq., on the Construction of the Drama.

*Poplar Institution*, East India Road.—Tuesday, April 18, at eight, R. Addams, esq., on Caloric, Illustrated with Chemical Apparatus, and Pleasing Experiments.

*Tower Street.*—Monday, April 17, at eight, Mr. Coupland, on the Mathematics.

*Bermondsey Mutual Instruction Society.*—Monday, April 17, at quarter past eight, Mr. Showler, on the Circulation of the Blood.

*Finsbury Mutual Instruction Society.*—Tuesday, April 18, at half past eight, Mr. Logan, on Phrenology.

## QUERIES.

*Lucifer Matches.*—I have been endeavouring to make "Lucifer Matches," but have not succeeded: perhaps you can give me a recipe in your next Number?

Yours, &c.

No. Chemist.

[The composition of which they are formed is the same as that used to make "Waterloo Crackers:" it is an exceedingly dangerous chemical compound, and we should therefore advise our correspondent not to attempt to make the Lucifers himself, but procure them at some of the shops. "No Chemist" should become one. We recommend him to read, and practise the experiments described in "Parke's Chemical Catechism," or "Griffins' Chemical Recreations."

Lucifers are made as follows. Equal quantities of chlorate of potash and sulphuret of antimony are to be made of a semifluid consistency with a little gum water. Matches pointed with brimstone are then to be dipped into it, and when the matches dry they will ignite on being drawn briskly through sand paper.—Ed. P. M.]

*Rubbers of Electrifying Machine.*—Could you inform me through the medium of your valuable Magazine, what it is that is put upon the rubber of an Electrifying Machine.

[An Amalgam formed of three parts of Mercury, two of Zinc, and one of Tin.—Ed. P. M.]

*Spots on Polished Steel.*—Will some of your readers have the kindness to inform me how I can remove Spots from Polished Steel, without injuring the polish. F.

## TO CORRESPONDENTS.

"A. L. O. R." It was stated by mistake in our last Number, that the Lunar Eclipse would take place on the 30th instant. It should have been "the 20th instant."

"J. C." We have very lately given an article on the subject.

"An Amateur Mechanic," "C. D. T." and "E. W." will see what we have said respecting the subject of their communications.

Will "Mr. Gregory" favour us with another description of his Rotary Pump?

We have received "Mr. Cowell's" Sash Suspenders and Letter. The subject shall receive our early attention.

We are obliged to "C. D. T." for the answer.

"C. G.'s" Query, shall have a reply.

Notice.—Some of our Correspondents have complained that their letters have not been answered. This is in consequence of their not having been directed properly. All communications should be addressed, "To the Editor of the Penny Mechanic, at Mr. Berger's, Holywell Street, Strand.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

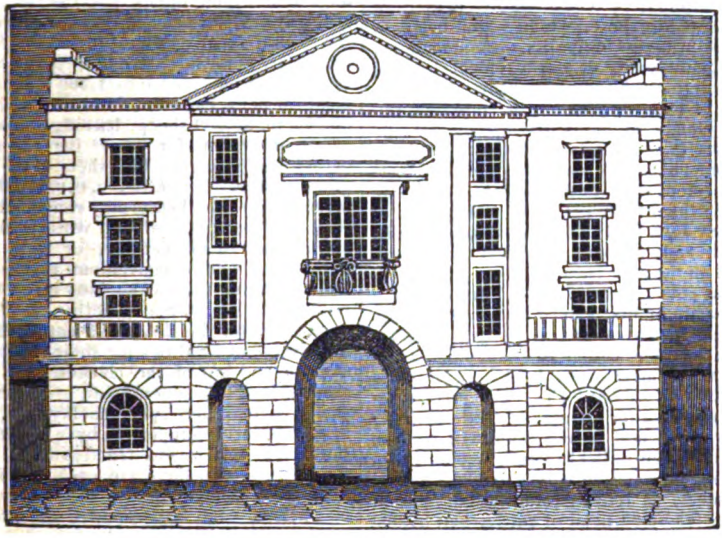
Digitized by Google

# THE PENNY MECHANIC.

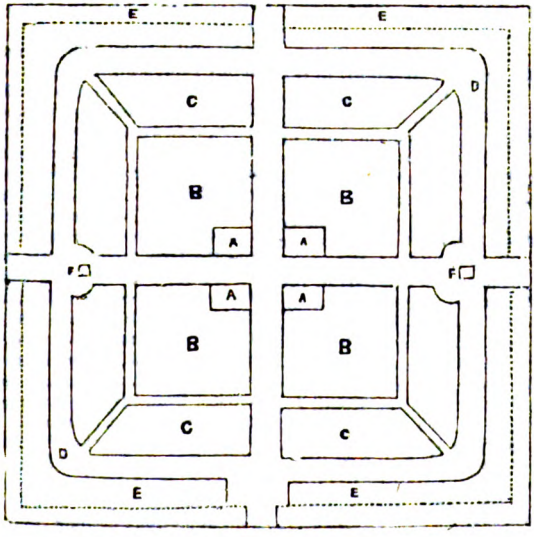
A MAGAZINE OF ARTS AND SCIENCES.

No. XXVI.] SATURDAY, APRIL 22, 1837. Vol. I.

## ISLINGTON LIVE CATTLE MARKET.



## GROUND PLAN.






Holloway Press: D. A. Doudney

Digitized by Google

## ISLINGTON LIVE CATTLE-MARKET.

THE question of the removal of Smithfield Market being again brought before the legislature, we have thought a sketch of the plan and dimensions of the lately-constructed, and now legalized market at Islington, may interest our readers. As, however, the comparative eligibility of the two markets for the sale of live cattle has elicited a considerable degree of party controversy, we beg distinctly to disclaim any participation in such feelings. Every discovery or improvement tending to enlighten the mind, improve the condition of man, or promote the practice and knowledge of humanity among all the classes of mankind, we deem fit subjects for our pages; we shall now state the facts connected with both markets. The site of Smithfield Market was in the reign of Henry I., a field with several ponds in it. Fairs and markets, however, had been held on the spot from the time of Alfred, about 886. Henry I. gave this field to a favourite of his, named Rahere.† He levelled it, and filled up the ponds, after which it was called Smoothfield. Justs and tournaments were held here down to the time of Edward IV. The present legalized area for the sale of cattle is under four acres and a half, and will contain about 1,500 bullocks, and 15,000 sheep, leaving no room for calves or pigs. Space, however, is required for 3,500, and at times for 5,000 head of cattle, and 35,000 sheep. The manner the business of the market is now conducted is by keeping the surplus cattle in the adjacent streets, till those in the market are sold and removed to make room for the admittance of others. From the time the cattle are brought into the market at night, to the closing of the market next day, comprehends a period of 18 hours, during which space of time they remain without food or water to allay a burning thirst brought on more speedily by over excitement and fatigue. As our business is only connected with facts, we will not dilate on the many evils generated by the want of space, or the treatment of the cattle. We refer those who may wish to see this part of the subject treated more at large, to a cheap pamphlet recently published by W. Clark, corner of Newgate and Giltspur-street.

The engraving represents the chief entrance, and ground plan of the New Market, situated in the Lower Road, Islington; the enclosed area for the reception of cattle comprises 15 acres, which is laid out in the form of a square, but the whole site, comprehending offices for clerks and other buildings consists of 21 acres. In the centre are four erections A, A, A, A, which have been constructed for the accommodation of eight bankers, or money-takers. The centre, which is intended to be occupied as an Exchange for the meeting of salesmen and graziers is quadrated by roads crossing it at right angles, and lying opposite to the entrance gateways. Drains and sewers run through the whole area. From the centre four spaces are portioned off for sheep, B, B, B, B, these are subdivided into 1,300 compartments or pens, capable of containing from 30,000 to 35,000 sheep, leaving ways in every direction for their ingress and egress: adjoining to the sheep-pens are other spaces for cattle, C, C, C, C, called layers, where the beasts may range. Here they may be foddered and watered from market-day to market-day, or until the purchasers find it convenient to remove them. Round these capacious layers is a wide road, D, D, D, D, connecting the other open ways for the sheep and cattle, offering excellent facilities for their free passage in and out of the market. On the other side of this general road are covered sheds, over other spacious layers E, E, E, E, exteriorly supported by a substantial brick wall about ten feet high, the four sides of which are each 800 feet long. The roofing of the sheds in span is 25 feet, and is supported interiorly on columns. These sheds are divided into stalls, where cattle may be exhibited for sale protected from the weather, with alleys for the purchasers to pass between them. Troughs for water are supplied from tanks F, F. The layers will contain about 10,000 bullocks.

The situation of this market is the best that could have been selected for its purpose; it lies open to most of the great roads from the northern and eastern counties, from which the principal supply of cattle and sheep to the London market is derived, and also communicates conveniently, by means of the New North Road and the City Road, with the greater part of the town, without goading the cattle first into the centre of the city, and then through all the narrow streets, in order to distribute them to the purchasers. It may be observed, likewise, that the New Road affords direct and easy access to the market from the western roads. We have given the ground plan of the quadrangular portion of the market for cattle and sheep. The lower part is of irregular form, and has been reserved for slaughter-houses, or to be occupied by enclosures for pigs. The objections against Smithfield Market

† There is a street now leading from St. John's-street, name Rahere-street.

Digitized by Google

are want of room, and the consequent punishment or cruelty inflicted on cattle and the inconveniences it entails on the persons who reside in its neighbourhood. The deterioration of property it occasions on the whole of the north side of London. The rendering the meat unwholesome by the cattle being too much excited and bruised immediately before their being killed; also its demoralizing effects on the lower classes from the brutality it occasions. To which may be added, the loss to the graziers and the public by the depreciation of the quality of the meat. The cruelty, however, inflicted on the cattle, is a question which should rouse the apathy of all persons who possess feelings of humanity. All animals taken from Smithfield Market and immediately slaughtered, are more or less in a feverish state; their heads, necks, hocks, and backs are most frequently loaded with extravasated blood, occasioned by the discipline they undergo in the hands of the drovers. Every market-day a certain number of beasts and sheep are so mutilated, exhausted or bruised in the market, as to render it necessary to have them forthwith slaughtered, the meat afterwards being sent to the dead market for sale. If the Islington Market were substituted for that of Smithfield, the cattle immediately on their arrival from the country would be accommodated with places of rest on the same spot where they would be offered for sale, having fodder and water for their refreshment the whole time.

The use of this market would also preclude the necessity of immediately driving the cattle purchased through the streets in droves, as they might remain on the spot until wanted. In Smithfield Market large numbers every market-day, which have not been sold, have to be driven back through the streets, and of course again to be brought to market until disposed of to a butcher. At Islington Market the unsold cattle or sheep, would remain in their layers undisturbed, and would not be repeatedly brought out to crowd the streets of London, and annoy the public. These are the main points of consideration for and against the two markets.

## THE HUMAN BODY.

### DIGESTION.—NO. I.

We have in former papers pointed out some of the more remarkable phenomena connected with the blood; we have described its composition, and the important purposes to which it is applied; it is proper that we should now explain the manner in which the blood itself is formed. The first process by which this is effected is termed Digestion.

There is no study can equal the study of ourselves: indeed, in acquiring a knowledge of the anatomy and physiology of the human body, we acquire a knowledge of nearly every other science. In the bones we see beautifully exemplified the strength of materials, and the most advantageous manner in which the mechanism of our frames can be employed; thus we learn something of mechanics. If we examine the organs of the senses, we at once perceive their adaptation to the laws of optics, acoustics, and heat, or the adaptation of those laws to *them*. Again, we inquire into the physiology of respiration, and we at once learn the constitution of the atmosphere; the nature of the gases which compose it, and the effect meteorological changes have upon our health. If we turn our attention to the subject of this paper, if we endeavour to learn something of the wonderful process of digestion, we at the same time enter into an investigation of some of the more interesting phenomena of chemistry. Thus, within ourselves, we have the means of learning many of the most striking facts in every branch of science. What more need we urge in favour of such a study. "The proper study for mankind is man." We use the word in its physical sense. We know the study is not popular, but it will be so; and we will do what we can to make it so. Persons at present have not the slightest knowledge on the subject, or they would desire to know more; and we are well assured that all men naturally have so deep an interest in the subject, that the time will arrive when a mother who from ignorance does not know how to preserve the health of her infant or herself, or when a man does not know how to avoid infringing the organic laws to which his physical constitution is liable, will be considered *very* ignorant, and very bad members of society. Let it not be supposed that in order to obtain this knowledge, a man or woman must necessarily study all the different sciences we have mentioned. On the contrary a very little knowledge of them is amply sufficient; and this will be acquired in making ourselves acquainted with the body itself. We shall see the truth of this in the present and following papers.

Digestion is the name given to the process by which the food we eat is converted into a fluid, which, after being exposed to the action of the air in the lungs, becomes blood. When we consider how various

Digitized by Google

are the substances and liquids taken into the stomach, we may well be surprised that any power or process, can convert them into a fluid so entirely dissimilar as the blood; yet such is the case. And this is effected by a chemical change in the food in the stomach.

The first operation in every chemical process is to divide the portion of substance to be acted upon very minutely, in order that the chemical agent may act as much upon the particles of the mass as possible; because all chemical changes are those which take place among the *particles* of matter; and in this chemistry is distinguished from mechanics, which relates only to the changes among *masses*. Previous to the food being introduced into the stomach, it is accordingly subdivided by the teeth. Another operation also takes place in the mouth. If we wished to dissolve a lump of chalk easily, and mix it equally in a quantity of water, we should not only divide it into minute portions, but we should make it into a semi-fluid mass, by mixing it with some liquid. If we did this it could easily be dissolved in a large quantity of water. Now a process very similar to this takes place during mastication. The food is not only minutely divided in the mouth, but it is also made into a pulpy mass by being mixed with the saliva. Thus it is prepared for a chemical change in the stomach, in the best possible manner that can be adopted.

Before describing the change that takes place in the stomach, we will see how the effect we have been describing is produced. First of the instruments by which it is accomplished—the teeth. In infancy, the child feeding on the softest food, has no occasion for, and is not provided with teeth; but as we advance in years, and require a different kind of food, the teeth are then formed. They are the hardest and whitest of the bones. The part above the gums is called the body of the tooth; that below, the fangs, or root; the boundary between them, just below the edge of the gum, is called the neck, where there is usually a slight depression. The body of the tooth is covered with enamel, and the fangs with a membrane commonly covering the bones, called the *periosteum*, which likewise lines the socket in which the tooth is placed. Each tooth has a cavity that is supplied with blood-vessels and nerves, through a hole in the root. The teeth are fixed into a bony substance called the Abveolar process, and they are kept in their places by the gums, which are exceedingly vascular, though possessed of little sensibility. The gums of infants have a hard ridge extending through their whole length, but this is not found in aged persons who have lost their teeth. At full maturity the number of teeth is usually thirty-two; sixteen above, and the same number below, the number, however, occasionally varies in different persons. The teeth are divided into three classes; the incisors; the canini; and the molares or grinders. The incisors are the four teeth in front of each jaw; in the upper jaw they are usually broader and thicker than those in the lower, over which they fall, by being placed a little obliquely—they are called incisors from their office being to divide and cut the food. The canine, or cuspidati, are the longest of all the teeth, and derive their name from their resemblance to a dog's tusk. There are a distinguishing characteristic of animals that feed on flesh. There are two in each jaw, one on either side of the incisors or cutting teeth. Mr. Hunter says, "a similarity in shape, situation, and use, may be traced from the most imperfect carnivorous animal, man, to the lion, which is the most perfectly carnivorous;" but in man the canine teeth, as also the incisors and molares, are shaped differently, not being so long as in some beasts, nor curved as in others. The molares or grinders are ten in number in each jaw. The incisors and canine have but one fang, but the three last grinders in the under jaw have two fangs, and those in the upper three fangs. The two grinders in each jaw next the canine are called bicuspides. The enamel of the teeth is the hardest production of the human body; it strikes fire with steel, and it resists decay when the centre of the tooth has fallen into dust. When the enamel is broken off the tooth, and its body exposed, the tooth quickly decays. The component parts of enamel are nearly the same as those of bone. Phosphate of lime is deposited, with a portion of animal gluten, and a small proportion of the carbonate of lime enters into its composition, the same as it does in bone. It is the union of the glutinous matter which bestows the extreme hardness, for when the tooth is within the jaw, and in an early stage of its formation, the deposition is soft, and its surface rough, but by a change in the surface which throws out the earthy deposit, the first deposition is penetrated with gelatinous secretion which bestows the density and extreme hardness of this crust. Enamel is peculiar to the teeth, and is only found upon the body of the teeth; when broken it appears fibrous or striated, and all the striæ are directed from the cir

Digitized by Google

cumference to the centre; it is thickest on the grinding surfaces, and on the cutting edges or points of the teeth, becoming gradually thinner as it approaches the neck, where it terminates insensibly. The enamal affords no appearance of vacularity, or of having any circulation of blood within it; it receives no tinge from madder when given to an animal during life, and no injection has yet been able to show that it possesses blood-vessels or absorbents.

## INDIAN METHODS OF WORKING IRON AND STEEL.

*On the Damascus Gun Barrels.*—The gun-barrels made at Bombay, in imitation of Damascus, so much valued by the Orientals for the beauty of their twist, are manufactured of iron hoops, obtained from European casks, mostly British. The more these hoops are corroded with rust, they are proportionably acceptable to the workman: should there be any deficiency of this necessary oxydation, they are regularly exposed to moisture, until they are sufficiently prepared for welding. Being cut into lengths of about twelve inches, they are formed into a pile, an inch or an inch and a half high, laying the edges straight, so as not to overlap each other: a longer piece is then so fitted as to return over each end, and hold the whole together in the fire. This pile is then heated to a welding heat, and drawn out into a bar of about one inch wide, and one third of an inch thick; it is then doubled up in three or more lengths, and again welded and drawn out as before; and this operation is repeated generally to the third or fourth time, according to the degree of fineness of twist required. The bar is then to be heated about a third of its length at a time, and being struck on the edge, is flattened the contrary way to that of the stratification. This part of the operation, brings the *wire* or *vein* outwards upon the strap. The barrel is then forged in the usual way, but much more jumping, or upsetting endways, by striking the barrel against the side of the anvil while it is of a welding heat, than in the English method, in order to render the twist finer. The most careful workmen always make a practice of covering the part exposed to the fire with a lute, composed of mud, clay, and the dung of cows or horses, in order to guard against any unnecessary oxydation of the metal. When the barrel is completed, the twist is raised by laying the barrel, from one to five days, either in vinegar, or a solution of the sulphate of iron, until the twist is raised; this process is called the *wire twist*.

To produce the *curl*, the bars or straps are drawn into bars about three quarters of an inch square, and twisted, some to the right and others to the left hand; one of each sort is then welded together, doubled up and drawn out, as before described; and according to the skill and experience of the workman, any intricacy of twist is produeed, by thus drawing out, doubling and twisting.

Sometimes, to save trouble, and economise the iron thus prepared, the artist will rough file an English barrel, weld a strap of Damascus iron spirally round it, or several straps are laid longitudinally along it, and welded on. A native artist never works with pit coal, under any consideration: charcoal from light wood forms his only fuel.

*On the Damascus Sword Blades.*—In making the sword blades, there are several methods used; some workmen make a pile of alternate layers of softer and harder cast-steel, with powdered cast-iron mixed with borax, sprinkled between each layer. These are drawn out to one-third more than the length of the intended blade, doubled up, heated, twisted and re-forged several times; *the twist is brought out* in the same way as that in the gun-barrels, namely, by the use of vinegar, or a solution of sulphate of iron.

Some sword-blades are forged out of *broad* plates of steel thus prepared, with a narrow plate of good iron welded between them, toward the back, and thus leaving *solid steel for the edge*, to a considerable depth. Others prefer to make them of one plate of steel, with a lamina of iron on each side of it, to give them strength and toughness. Swords of this description were tempered in my brother's presence, in the following compound; and, as he states, with considerable effect.

*The Hardening Composition.*—The blade was covered with a paste, formed of equal parts of barilla, powdered egg-shells, borax, common salt, and crude soda, heated to a moderate read heat; and just as the red was changing to a black heat, quenched in spring-water.

From the information of the workman, it appears that Damascus obtains all its steel from the upper part of the Deccan, where it is called *jonlode k nd*, or Indian steel, of which there are great quantities, and but little or no demand for it. The *Damasuque* (or *joar*) is natural to this steel; and the veins in it are raised by immersing the blades in acid solutions.—*Young Mechanic.*

Digitized by Google

# MANUFACTURES.

## PAINTING ON GLASS.

At the time when vast sums of money were expended by pious individuals in endowing churches, and chapels, and in repairing and building cathedrals, the art of glass painting attained a very high state of perfection. From this state however it soon declined when the patronage it had been used to receive was no longer extended to it, until at last it was so much neglected that it was supposed to be a lost art. This however, it appears is not the case. A knowledge of the means by which the artists of the middle centuries were enabled to produce such beautiful specimens of stained glass still remains. A correspondent in a late number of the Philosophical Magazine communicates the following interesting particulars.

It is a singular fact, that the art of glass-painting, practised with such success during former ages from one end of Europe to the other, should gradually have fallen into such disuse, that in the beginning of the last century it came to be generally considered as a lost art. In the course of the eighteenth century, however, the art again began to attract attention, and many attempts were made to revive it. It was soon found by modern artists, that by employing the processes always in use among enamel painters, the works of the old painters on glass might in most respects be successfully imitated; but they were totally unable to produce any imitation whatever of that glowing red which shed such incomparable brilliancy over the ancient windows that still adorn so many of our churches. For this splendid colour they possessed no substitute, until a property, peculiar to silver alone among all the metals, was discovered, which will presently be described. The art of enamelling on glass differs little from the well-known art of enamelling on other substances. The colouring materials (which are exclusively metallic) are prepared by being ground up with a *flux*, that is, a very fusible glass, composed of silex, flint-glass, lead, and borax: the colour with its flux is then mixed with volatile oil, and laid on with the brush. The pane of glass thus enamelled is then exposed to a dull red heat, just sufficient to soften and unite together the particles of the flux, by which means the colour is perfectly fixed on the glass. Treated in this way, gold yields a purple, gold and silver mixed a rose colour, iron a brick-red, cobolt a blue; mixtures of iron, copper and manganese, brown and black. Copper, which yields the green in common enamel-painting, is not found to produce fine colour when applied in the same way to glass, and viewed by transmitted light; for a green therefore recourse is often had to glass coloured blue on one side and red on the other. To obtain a yellow, silver is employed, which either in the metallic or in any other form, possesses the singular property of imparting a transparent stain, when exposed to a low red heat in contact with glass. This stain is either yellow, orange, or red, according to circumstances. For this purpose a flux is used: the prepared silver is merely ground up with ochre or clay, and applied in a thick layer upon the glass. When removed from the furnace the silver is found not at all adhering to the glass; it is easily scraped off, leaving a transparent stain, which penetrates to a certain depth. If a large proportion of ochre has been employed, the stain is yellow; if a small proportion, it is orange-coloured; and by repeated exposure to the fire, without any additional colouring matter, the orange may be converted into red. This conversion of orange into red is, I believe, a matter of much nicety, in which experience only can ensure success. Till within a few years this was the only bright red in use among modern glass-painters; and though the best specimens certainly produce a fine effect, yet it will seldom bear comparison with the red employed in such profusion by the old artists.

Besides the enamels and stains above described, artists, whenever the subject will allow of it, make use of panes coloured throughout their substance in the glass-house melting-pot, because the perfect transparency of such glass gives brilliancy of effect, which enamel-colouring, always more or less opake, cannot equal. It was to a glass of this kind that the old glass-painters owed their splendid red. This in fact is the only point in which the modern and ancient processes differ, and this is the only part of the art which was ever really lost. Instead of blowing plates of solid red, the old glass-makers used to *flash* a thin layer of red over a substratum of plain glass. Their process must have been to melt side by side in the glass-house a pot of plain and a pot of red glass: then the workman, by dipping his rod first into the plain and then into the red glass pot, obtained a lump of plain glass covered with a coating of red, which by dexterous management in blowing and whirling, he extended into a plate, exhibiting on its surface a very thin stratum of the

Digitized by Google

desired colour. That such was the method in use, an attentive examination of old specimens affords sufficient evidence. One piece in the possession of the Editor of the Philosophical Magazine exhibits large bubbles in the midst of the red stratum; another consists of a stratum of red inclosed between two colourless strata: both circumstances plainly point out the only means by which such an arrangement could be produced. In this state the glass came into the hands of the glass-painter, and answered most of his purposes, except when the subject required the representation of white or other colours on a red ground: in this case it became necessary to employ a machine like a lapidary's wheel, partially to grind away the coloured surface till the white substratum appeared.

The material employed by the old glass-makers to tinge their glass red was the protoxide of copper, but on the discontinuance of the art of glass-painting the dependent manufacture of red glass of course ceased, and all knowledge of the art became so entirely extinct, that the notion generally prevailed that the colour in question was derived from gold. In 1793 the French government actually collected a quantity of old red glass, with the view of extracting the gold by which it was supposed to be coloured! Le Vieil was himself a glass-painter employed in the repair of ancient windows, and the descendant of glass-painters, yet so little was he aware of the true nature of the glass, that he even fancied he could detect the marks of the brush with which he imagined the red stratum had been laid on! It is not a little remarkable that the knowledge of the copper-red should have been so entirely lost, though printed receipts have always existed detailing the whole process. Battista Porta (born about 1540) gives a receipt in his *Magia Naturalis*, noticing at the same time the difficulty of success. Several receipts are found in the compilations of Neri, Merret and Kunckel, from whence they have been copied into our Encyclopædias. None of these receipts however state to what purposes the red glass was applied, nor do they make any mention of the *flashing*. The difficulty of the art consists in the proneness of the copper to pass from the state of protoxide into that of peroxide, in which latter state it tinges glass green. In order to preserve it in the state of protoxide, these receipts prescribe various doxygenating substances to be stirred into the melted glass, such as smiths' clinkers, tartar, soot, rotten wood and cinnabar.

One curious circumstance deserves to be noticed, which is, that glass containing copper when removed from the melting-pot sometimes only exhibits a faint greenish tinge, yet in this state nothing more than simple exposure to a gentle heat is requisite to throw out a brilliant red. This change of colour is very remarkable, as it is obvious that no change of oxygenation can possibly take place during the *recuisson*.

## COWELL'S SASH SUSPENDERS.

*To the Editor of the* PENNY MECHANIC.

SIR,—I observe in your Magazine of March 18, a plan for detaching sashes from their lines,—as reference is made to my plan, and an idea raised, that in consequence of its being a patented article, the expense will prove an obstacle,—I forward the accompanying circular, &c., hoping it will fully explain and satisfy you that your correspondent is unnecessarily alarmed, if expense is the only consideration that prompts the introduction of his plan.

I likewise forward one of my suspenders, each iron and brass, that you may see at once the principle I have adopted —the iron I enable the trade, viz. ironmongers, to sell at 4½*d.* each, the brass at 7½*d.* each. So that per sash as named by your correspondent, the cost would be, if fitted with iron suspenders, 9*d.*, if with brass, 1*s.* 3*d.*; but a pair of sashes, including the bead bolt and side plates, which are indispensable, the sum named in my circular is from 2*s.* 6*d.* to 5*s.*. Its merits compared with Mr. Clement's suggestion I leave to your decision, and am most respectfully

Your Obedient Servant.

H. B. COWELL.

*** We are sincerely glad to find that for so trifling a sum so many of the accidents from window-cleaning we have before spoken of can be prevented. "Cowell's Sash Suspender" ought to be used for the windows of every house that is hereafter built; and as every one can now have their windows made so much more convenient for cleaning, at so little expense, we hope the invention will come into general use. It is exceedingly simple in its construction, and exceedingly ingenious. Mr. Cowell deserves well of society for having made public a plan by which so many lives may be preserved that are now being constantly placed in jeopardy.—ED. P. M.

Digitized by Google

## MISCELLANIES.

*The Best Method of Preparing Glue.*—In the purchase of glue, it would be well to select it in warm, damp weather, for then if the oily substance has not been thoroughly separated in its manufacture, it will be soft like India rubber. This will neither dry nor hold well, and after being melted, will in a short time turn black and taint. The method I have adopted for improving glue, is to add a gill of vinegar, alcohol, or cider, when dissolving it in a common glue pot, and afterwards, as much water as necessary. Glue prepared in this way, will melt much quicker and hold the heat longer, than in the common method, and when used on wood, will dry much better and will not taint. The vinegar I think is best, as it does not evaporate so rapidly as alcohol.

*A Large Tree.*—An oak tree was a short time ago felled in Ludlow, near Shropshire, the produce of which was thirty-nine tons of timber, fifty-five cords of wood, two hundred park pales, and four cords of brackets. A bough broke off before the tree was cut down which weighed seven tons and a half. Three men were employed a month in stacking it. The tree was valued at £165.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday, April 24, and Thursday, 27th, at 7 o'clock, H. James, esq., on the Sacred Poetry of Great Britain.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, April 26, at half-past eight, Mr. Cull, on Phrenology.—Friday, 28, Dr. Ritchie, on Optics, &c.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, April 27, at eight, C. Buckingham, esq., M.P., on Palestine.

*Lambeth Literary and Scientific Institution.*—Tuesday, April 25, at half-past eight, W. T. J. Morton, esq., on the Constitution of the Atmosphere.

*Southwark Literary Society.*—Wednesday, April 26, F. Statham, esq., on Optics, at eight.

*Poplar Institution*, East India Road.—Tuesday, April 25, at eight, H. Brown, esq., on the Nature and Tendency of Works of Fiction.

*Mutual Instruction Society*, 16 Great Tower-street.—Monday, April 24, at eight, Mr. Shearman on the Emancipation of the Jews.

*Bermondsey Mutual Instruction Society.*—Monday, April 24, at quarter past eight, Mr. Showler, on the Circulation of the Blood.

*Finsbury Mutual Instruction Society.*—Tuesday, April 25, at half past eight, Mr. J. Smith, on the Acquisition of Knowledge.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Having observed a query in your valuable periodical No. 24, "why, if the rays of the Sun are suffered to fall on the fire, they will put it out," I should advise "W. C. C." to peruse "Blair's Why and Because, or the Curious Child answered," there he would find this answer. "Because the rays engage the oxygen which previously supported the fire."

I am, Sir, Yours, &c.
D. B.

CAN any of your correspondents inform me of a Cement for Glass and China? C. G.

[Dissolve an ounce of Mastic in highly rectified Spirits of Wine, soak an ounce of Isinglass in water until quite soft, then dissolve it in pure Rum or Brandy, until it forms a strong glue, to which add about a quarter of an ounce of Gum Ammoniac, well rubbed and mixed. Put the two mixtures together in an earthen vessel, over a gentle heat, when well united, the mixture may be put into a phial, and kept well stopped. When wanted for use, the bottle must be set in warm water: the glass must also be warmed and the cement applied. The broken surfaces must be kept in contract for at least a day until the cement is fully set.]

*Preparing Quills.*—SIR, will you be kind enough to inform me through the medium of your valuable little Magazine, the manner in which quills are prepared or clarified? I have tried all the recipes as given in many Cyclopædias, and have not succeeded—your reply in next number will oblige
C. D.

*Tracing Paper.*—Which is the best method of preparing Tracing Paper for Architectural purposes? S. T. COOPER.

## TO CORRESPONDENTS.

NOTICE.—Our readers will perceive that the PENNY MECHANIC is now printed in a much smaller type than it has been hitherto. By this means we shall be enabled to give as much additional matter as if we increased the size of the work, one-fourth; and it will now contain about the same quantity of print as the *Penny Magazine*. We make this alteration because we did not wish to increase the price of the work; and although we shall of course incur an additional expense, we have no doubt it will be fully compensated by an increased sale.

"S. T. Cooper," received the Paper and Diagram. An article on "Waterspouts," shall be inserted shortly.

"R. R. Mercury." Spirits of Wine is preferable in some cases.

If "A Secretary" wishes to have the Lectures of his Society noticed, he must forward a list of them to us.

We will insert the letter respecting "A New Method of Ascending and Descending in Balloons," very shortly.

"Amateur," had better send his drawing and the particulars of the invention to the Society of Arts, Adelphi.

"A Mechanic." We shall be happy to receive the Drawing. Let the description be as full as possible.

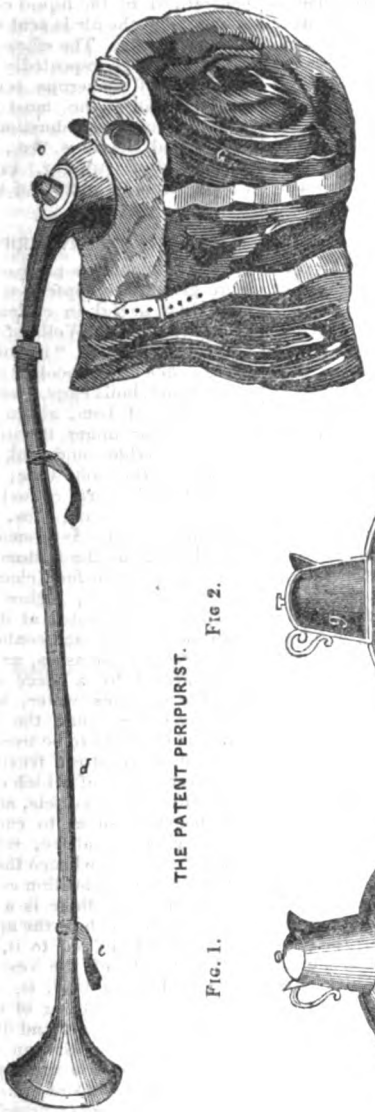
London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXVII.] SATURDAY, APRIL 29, 1837. Vol. I.



ROBERTS' HOOD AND MOUTH-PIECE.

THE PATENT PERIPURIST.

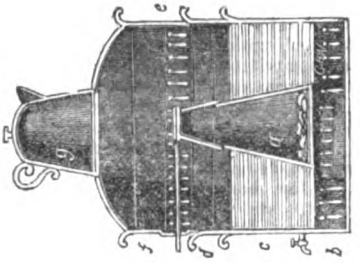


Fig 2.

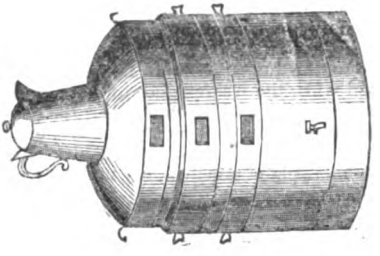


Fig. 1.



Holloway Press: D. A. Doudney.

Digitized by Google

### ROBERTS' HOOD AND MOUTH-PIECE.

THE object of this instrument is to enable a person to enter with safety the rooms of a house when on fire, although such rooms may be full of smoke, which would instantly suffocate him unless protected by the hood and mouth-piece. The inventor, Mr. Roberts, is an ingenious working mechanic, who besides the above useful piece of apparatus, has invented another means of protecting human life when exposed to imminent peril. We allude to his improvement of Sir Humphrey Davy's safety lamp; of which lamp we gave an engraving a short time since. Whether Sir Humphrey Davy's lamp is really so dangerous as it is represented to be, is perhaps a question of some doubt. But there can be no question that as improved by Mr. Roberts it is perfectly safe. We mention this invention, although but remotely, if at all connected with the subject of this article, because we fear that Mr. Roberts has not received the patronage of which his talents are deserving. The hood and mouth-piece is an example of his ingenuity. By providing every fireman with one of them, property to a great amount that is now destroyed might be preserved, and not property alone, but often human life. More than one melancholy instance has lately occurred where for the want of the means of entering a room filled with suffocating smoke, life has been sacrificed. In the front page we give an engraving of the instrument that will enable a person to do this. It consists of a leather cap or hood, *a*, which entirely covers the head and face, with strong glasses before the eyes. The lower part of the hood is padded with soft cotton, covered with wash leather, which being drawn tight round the neck by a strap and buckle, excludes the surrounding air. The upper part of the proboscis, *b*, is of sufficient capacity to include the nose and mouth of the wearer, and forms the channel through which he respires. A trumpet-mouthed orifice is formed at *c*, provided with a good cork stopper, which is secured by a small brass chain; the use of this appendage is to afford a ready relief to the lungs, without taking off the hood when the wearer goes to the door or window of a building on fire, for the purpose of respiring a purer atmosphere, or to consult with persons on the outside. Below this part is attached, by means of an union joint, a flexible tube, *d*, about two feet six inches long, and terminating in a funnel five inches in diameter, in which is contained a sponge saturated with water. The flexible pipe is kept distended by a spiral coil of wire, and the straps *e e* are for the purpose of buttoning it to the dress of the wearer, so as not to encumber him, or impede his exertions. The operation of the apparatus is as follows:—The gaseous and other noxious matters which exist in the apartment, are, by the act of inspiration, obliged to pass through the funnel of the tube, where they are absorbed and neutralized by the liquid contained in the sponge, and the air is sent up to the lungs in a pure state. The efficacy of the apparatus has been repeatedly proved, in the presence of numerous scientific individuals, amidst the most dense smoke, arising from the combustion of wool, wet hay, wood shavings, &c., besides large quantities of sulphur, in temperatures varying from 90 to 240° of Fahr.

### THE PATENT PERIPURIST.

THIS very ingenious piece of apparatus, if more generally adopted, would be found exceeding useful in culinary operations. The patentee, Mr. Wells, states in his prospectus of it, that "it boils water, prepares coffee and chocolate in a very superior manner, boils eggs, cooks a beef-steak or a slice of ham, all in less than ten minutes. For dinner, it will prepare soup, steam vegetables, and cook fish, chops, or steaks, at the same time; and for these one farthing's worth of fuel is sufficient." Fig. 1, is an external view, and fig. 2 is a vertical section; *a* is a small cone of cast iron, having at the bottom a grating, on which is put the fuel (charcoal), broken into small pieces; below this a small chamber, *b*, perforated at its sides for the admission of air, and containing a small pan to receive the ashes, and also to light the charcoal by a piece of paper; the vessel *c* contains water, which entirely surrounds the cone; the next vessel *e* above is intended to be used as a steamer; it has in its centre a frustrum of a cone, the lower edges of which descend below the bottom of the vessels, and fit upon the cone beneath, so as to carry up the flue to the chamber above, which has open perforated sides, whence the vapours produced by the combustion escape. On the top of the cone there is a valve for enlarging or diminishing the aperture, having a horizontal rod fixed to it, which passes to the outside of the vessel, as shown. The vessel over this, *f*, is, we suppose, a stew-pan, or something of the kind; it is heated by the hot air and direct influence of the fire; above this pan is placed in a cavity of the cover a small pot for warming small quantities of liquid. There are several appendages or vessels for peculiar purposes, such as the boiling of eggs, &c.

Digitized by Google

which fit one over another in a similar manner to those described. The apparatus is proposed to be used on the breakfast or dining-table, to be taken in a carriage, in a boat, or carried by pedestrians.

## PLANTS GROWING DOWNWARDS.

*To the Editor of the Penny Mechanic.*

Sir,—Sometime since I learnt from one of the papers, that the supposition that plants would not grow with their roots upwards, had been proved incorrect, and that at a florist's in Cheapside, near the New Post Office, a flower might be seen *growing downwards*. This I found to be the case; and lately the flower (a hyacinth), bloomed. The peculiar manner in which this flower has grown, induced me to give it a glance when I passed the shop in the morning, and to my surprise, I perceived that every day or two the hyacinth changed colour: one day it was blue, and then pink, then white, and I don't know how many more colours. It struck me at first, that some trick had been performed to make the flower *appear* to grow downwards; but on consideration I can hardly suppose this to be the case. I therefore request the favour of the insertion of this letter, in order to know whether any of your readers have tried and succeeded in making plants grow downwards, as I suppose it is not a matter of any very great difficulty, since the florist before mentioned, can change the flower every two or three days.

Yours obediently,

Comeo.

## A DIVING APPARATUS.

A diving apparatus was invented during the American war by a Mr. Bushnel, of Connecticut, called a submarine vessel, the use of which was to blow up and destroy the British ships and vessels employed in the American war. The external shape bore some resemblance to upper tortoise-shells of equal size joined together. The inside was capable of containing the operator, and air sufficient to support him 30 minutes without receiving fresh air. At the bottom opposite to the entrance, was fixed a quantity of lead for ballast. At one edge, which was directly before the operator, who sat upright, was an oar for rowing forward or backward. At the other edge was a rudder for steering. An aperture at the bottom with its valve, was designed to admit water for the purpose of descending; and two brass forcing pumps served to eject the water within, when necessary for ascending. At the top there was likewise an oar for ascending or descending, or continuing at any particular depth. A water gauge, or barometer, determined the depth of the descent, and a compass directed the course, and a ventilator within supplied the vessel with fresh air.

When the navigator would descend, he placed his foot upon the top of a brass valve, depressing it, by which he opened a large aperture in the bottom of the vessel, through which the water entered at his pleasure; when he had admitted a sufficient quantity, he descended gradually; if he admitted too much, he ejected as much as was necessary to obtain an equilibrium, by the two brass forcing pumps. When he had obtained an equilibrium, he could row up or down, or continue at any particular depth, with the oar placed near the top of the vessel, formed upon the principle of a screw, the axis of the oar entering the vessel; by turning the oar one way he raised the vessel, by the other way he lowered it. The internal shape of the vessel verged towards an ellipsis, as near as the design would allow; but every horizontal section, although elliptical, was as near a circle as could be admitted. The body of the vessel was made exceedingly strong; and, to strengthen it as much as possible a firm piece of wood was framed, paralled to the conjugate diameter, to prevent the sides from yielding to the great pressure of the incumbent water, in a deep immersion. In the fore part of the brim of the crown of the machine, was a socket, and an iron tube passing through the socket; the tube stood upright, and could slide up and down in the socket of six inches; at the top of the tube was a wooden screw, fixed by means of a rod which passed through the tube, and screwed the wood fast upon the top of the tube; by pushing the wood screw up against the bottom of a ship, and turning it at the same time, it would enter the planks; when the wood screw was firmly fixed, it could be cast off by unscrewing the rod which fastened it upon the top of the tube. Behind the submarine vessel was a place, above the rudder, for carrying a powder magazine, large enough to contain 150 lbs. of powder, with apparatus used in firing it, and was secured in its place by a screw. A strong piece of rope extended from the magazine to the wood screw above mentioned, and was fastened to both. When the wood screw was fixed, and to be cast off from its tube, the magazine was to be cast off likewise by unscrewing it, leaving it hanging to the wooden screw; it was lighter than the

Digitized by Google

water that it might rise up against the object, to which the wood screw and itself were fastened. Within the magazine was an apparatus constructed to run any proposed length of time under twelve hours; when it had run out its time, it unpinioned a strong lock resembling a gun-lock, which gave fire to the powder. This apparatus was so pinioned that it could not possibly move, till, by casting off the magazine from the vessel it was set in motion. The skilful navigator or operator could swim so low on the surface of the water, as to approach very near a ship, in the night, without fear of being discovered, and might if he choose, approach the stem or stern above water, with very little danger. He could sink very quickly, keep at any depth, and row a great distance in any direction he desired, without coming to the surface; and when he rose to the surface, he could soon obtain a fresh supply of air, when, if necessary, he might descend again and pursue his course. The first experiment was made with two ounces of powder, which were exploded four feet under water, to prove that powder could be exploded under water. The second experiment was made with two pounds of powder, inclosed in a wooden bottle and fixed under a hogshead, with a two-inch oak plank between the hogshead and the powder. The hogshead was loaded with stones as deep as it could swim; a wooden pipe descending through the lower head of the cask, and through the plank, into the powder contained in the bottle, was primed with powder. A match put in the priming exploded the powder, which produced a wonderful effect, rending the plank into pieces, demolishing the hogshead, and casting the stones many feet into the air. After many other similar experiments, the operator was made to descend, and continue at particular depths, without rising or sinking, row by the compass, approach a vessel, go under her and fix the wooden screw, before mentioned, into the bottom, &c., until he was thought sufficiently expert to put any design into execution.

C. H. S.

## BIOGRAPHICAL SKETCHES.

### JAMES BRINDLEY.

A MAN of talent, it is said, may be made so by circumstances, but a man of genius must be formed by nature. Some men are born poets; some philosophers; but the subject of our present sketch was born a *Mechanic!* And if ever there has been an instance of natual genius, of genius which in defiance of every difficulty that could be opposed to its development, succeeded in benefiting mankind and procuring for its possessor a name that will never be forgotten, such an instance is afforded us in the life of James Brindley.

To become successful as an engineer requires in most men a high degree of mental cultivation; unwearied assiduity in their profession, and extensive mathematical knowledge; yet the subject of our sketch has been truly described as "in appearance and manners, as well as acquirements, a mere peasant. Unlettered, and rude in speech, it was easier for him to devise means for executing a design, than to communicate his ideas concerning it to others." Yet notwithstanding these great, and what would have been to most men, insurmountable difficulties, Brindley triumphed over all, and earned for himself a reputation that is not excelled even by the most renowned of those who have had all the advantages that education can bestow, to second the exertions of their genius. The lesson his biography conveys we will let our readers discover for themselves; but we cannot forbear reminding them, that the poorest and the least educated amongst them have far less difficulties to contend with than those which beset the early life of Brindley.

This highly ingenious individual (whose superior judgment in planning canals, coupled with ability for surmounting every difficulty that occurred to impede their progress, will be perpetuated as long as the history of inland navigation lasts,) was born at Tunstead, a hamlet in the parish of Tideswell, Derbyshire, in the year 1716. Although his father originally possessed a small freehold, the destructive consequences of an attachment to sporting had compelled him to alienate his property, and young Brindley's education was not only neglected, but he was moreover reduced to the necessity of contributing to support the family by the lowest occupations of rustic labour. About his seventeenth year, however, this rising genius apprenticed himself to a mill-right, named Bennet, who resided at Macclesfield, in Cheshire; where his predilection for mechanics soon began to develop itself, in the invention and execution of various pieces of work, which were accomplished by him without his having obtained any previous instruction. Continuing to produce satisfactory proofs of his advancing acquaintance with the principles of mechanism, evidenced by the improvements which he introduced, his master, at the expiration of his apprenticeship, at once confided to him the management of his business.

Digitized by Google

Commencing trade for himself, some years after, Brindley soon extended the reputation of his skill; so that, in 1752, he was employed to erect a water-engine of unusual powers, for the purpose of draining certain coal-mines in the neighbourhood of Clifton, in Lancashire. Here he immediately manifested that peculiar ability for which he became so singularly eminent; for he succeeded in the arduous project of driving a tunnel through a rock nearly six hundred yards in length, in order to convey a stream of water from the river Irwell, which was to effect the turning of a wheel fixed thirty feet beneath the surface of the earth. During the year 1755, Mr. Brindley was solicited to execute the larger-wheels for a silk-mill at Congleton; when the mechanist who had been engaged to organize other parts of the machinery, and to superintend the whole, proving to be incompetent, the entire structure was committed to Mr. Brindley. He not only executed the original plan in a masterly manner, but introduced several curious and valuable improvements, as well in the construction of the engine itself, as in making the wheels and pinions belonging to it. Probably about the same time, the flint-mills in the Staffordshire potteries received several improvements from his ingenuity. In 1756, he undertook the erection of a steam-engine upon a new plan, at Newcastle-under-Line; and was sedulously engaged in this work, when, fortunately for the community, his attention was demanded for objects of higher importance, and successfully directed to undertakings more calculated to display the boldness of his genius.

Francis Duke of Bridgewater having, before he became of age, determined to attempt the then hazardous enterprize of carrying a canal from his works at Worsley to Manchester, had no sooner succeeded his brother, in the title and estates of his house, than he was induced, owing to the extended celebrity of Mr. Brindley, to consult with him on the practicability of his design. Thoroughly satisfied as to the capability of this self-taught genius, the Duke had discernment enough to entrust to him the unfettered direction of this arduous undertaking. Brindley having surveyed the estate at Worsley and pronounced the projected navigation to be practicable, an Act of Parliament was accordingly obtained for making a navigable canal from Salford, near Manchester, to Worsley. Confiding in his own mind, Brindley here "projected and adopted those leading principles, for the execution of these kind of works, which he ever afterwards adhered to, and in which he has been imitated by all succeeding artists. To preserve, as much as possible, the level of his canals, and to avoid the mixture and interference of all natural streams, were projects at which he constantly aimed. To accomplish these, neither labour nor expense were spared; and his genius seemed to delight in overcoming all obstacles, by the discovery of new and extraordinary contrivances. Encouraged by the complete success of his first line of canal, the Duke of Bridgewater obtained an act for extending it, from the river Worsley, over the Irwell, to Manchester; and which he afterwards extended to the Mersey. This canal, which is ninety-three miles long, begins at Worsley Mill, about seven miles from Manchester, where the Duke cut a bason capable of holding all his boats. The canal enters a hill by a subterraneous passage, large enough for the admission of flat-bottomed boats, which are towed along by hand-rails, near a mile under ground, to his coal-works; then the passage divides into two, both of which may be continued at pleasure. This passage is in some places cut through the solid rock, and in others is arched with brick. Air-funnels are cut in several places to the top of a considerable eminence. The arch at the entrance is about six feet in breadth, and widens in some places for the boats to pass each other: the boats are loaded from waggons, which run upon rail-ways. Sometimes this canal is carried over public roads, by means of arches. One of the most stupendous works on this canal is the aqueduct over the river Irwell, where the canal runs upwards of forty feet above the river; and where the barges are seen passing on the canal, whilst the vessel in the river are also in full sail under them! About three miles from Worsley, begins this amazing aqueduct; which is carried two hundred yards over a valley.

## MANUFACTURES.

### PAINTING ON GLASS.

The art of tinging glass by protoxide of copper flashing it on crown-glass, has of late years been revived by the Tyne Company in England, at Choisy in France, and in Suabia in Germany, and in 1827 the Academy of Arts at Berlin gave a premium for an imperfect receipt. To what extent modern glass-painters make use of these new glasses I am ignorant; the specimens that I have seen were so strongly coloured as to be in parts al-

Digitized by Google

most opake, but this is a defect which might no doubt be easily remedied.

Though it is difficult to produce the copper glass uniformly coloured, it is easy to obtain streaks and patches of a fine transparent red. For this purpose it is sufficient to fuse together 100 parts of crown-glass with one oxide of copper, putting a lump of tin into the bottom of the crucible. Metallic iron employed in the same way as the tin throws out a bright scarlet, but perfectly opake. I shall now conclude these observations by a few notices respecting glass tinged by fusion with gold, which, though never brought into general use among glass-painters, has I know been employed in one or two instances, flashed both on crown and also on flint-glass. Not long after the time when the art of making the copper-red glass was lost, Kanckel appears to have discovered that gold melted with flint-glass was capable of imparting to it a beautiful ruby colour. As he derived much profit from the invention, he kept his method secret, and his successors have done the same to the present day. The art, however, has been practised ever since for the purpose of imitating precious stones, &c., and the glass used to be sold at Birmingham for a high price under the name of *Jew's glass*. The rose-coloured scent-bottles, &c. now commonly made, are composed of plain glass flashed or coated with a very thin layer of the glass in question. I have myself made numerous experiments on this subject, and have been completely, and at last uniformly, successful in producing glass of a fine crimson colour. One cause why so many persons have failed in the same attempt, I suspect is that they have used too large a portion of gold; for it is a fact, that an additional dust of gold, beyond a certain point, far from deepening the colour, actually destroys it altogether. Dr. Lewis states that he once produced a potfull of glass of beautiful colour, yet was never able to succeed a second time, though he took infinite pains, and tried a multitude of experiments with that view. I have found that a degree of heat, which I judge sufficient to melt cast-iron, is not strong enough to injure the colour. It would appear, that in order to receive the colour it is necessary that the glass should contain a proportion either of lead, or of some other metallic glass. I have found bismuth, zinc, and antimony to answer the purpose, but have in vain attempted to impart any tinge of this colour to crown-glass alone.

Glass containing gold exhibits the singular change of colour on being exposed to a gentle heat, as has been already noticed with respect to glass containing copper. The former when taken from the crucible is generally of a pale rose-colour, but sometimes colourless as water, and does not assume its ruby colour till it has been exposed to a low red-heat, either under a muffle or in the lamp. Great care must be taken in this operation, for a slight excess of fire destroys the colour, leaving the glass of a tingy brown, but with a blue transparency, like that of gold-leaf. These changes of colour have been vaguely attributed to change of oxygenation in the gold; but it is obviously impossible that mere exposure to a gentle heat can effect any chemical change in the interior of a solid mass of glass, which has already undergone a heat far more intense. In fact I have found the metallic gold gives the red colour as well as the oxide, and it appears scarcely to admit of a doubt, that in a metal so easily reduced, the whole of the oxygen must be expelled long before the glass has reached its melting point. It has long been known that silver yields its colour to glass while in the metallic state, everything leads one to suppose that the case is the same as gold.

There are still some other substances by means of which I find it is possible to give a red colour to glass, and that is a compound of tin, chromic acid, and lime; but my trials do not lead me to suppose that glass thus coloured will ever be brought into use.

## NATURAL PHENOMENA.

### ECLIPSES.

All uninformed persons regard eclipses with some degree of terror, and among savages it is customary to make a great noise during the occurrence of the phenomena, in order to prevent the evil which they suppose would otherwise inevitably result. A late writer has very truly remarked that in times of ignorance men are alarmed at all celestial phenomena, the recurrence of which takes place at periods too remote to be readly calculated, and which accordingly appear to be guided by no fixed laws; whilst more important and obvious appearances excite no surprise because they are frequent, and because they occur at well-known periods: thus the changes of the moon are observed without alarm, while the less obvious occurrence of an eclipse has scattered dismay over an army or a nation. An in-

Digitized by Google

cidental and considerable assistance has been derived to chronology from this superstitious feeling. Eclipses were thought to be connected, in some secret manner with the destinies of nations, and their occurrence has been carefully recorded, when near the time of some great battle or other political event, of whose epoch we should otherwise remain in ignorance. Astronomical science shows how to determine with the greatest exactness the hour of any given eclipse; and we are thus enabled to fix with precision the date of any event which may have been thus accompanied, to confirm the statement of an historian, or to correct his errors. But as the computation of eclipses is attended with considerable difficulty, a few only of the readers of history are able to carry on these researches for themselves. On this account catalogues of eclipses have been calculated by astronomers for many thousand years, by a reference to which any chronological point connected with these phenomena may be at once determined.

Eclipses take place every half year, and at each period there may be one, two, or three eclipses; if one only, it must be an eclipse of the sun; if two, there will be one of each luminary; and if three, there will be two of the sun, with one of the moon between them.

The sun is eclipsed whenever the moon comes between it and the earth, so that the eye of a spectator on the earth, is in a straight line with the centres of the sun and moon. Sometimes what is called our annular eclipse takes place, such as that of the 15th May last year, when a ray of light appears round the disk of the moon. This is in consequence of the apparent diameter of the moon being less than that of the sun; at other times it is greater, and then a total eclipse takes place.

The moon is eclipsed, as it was last week, whenever the earth comes between it and the sun; in consequence of which it is deprived of the light of that luminary. As the moon revolves round the earth once in every twenty-eight days, it might at first be supposed that an eclipse would take place once in every month, as the moon must during that period pass between the earth and the sun. This would be the case only the moon does not pass in an exact line between the earth and the sun: the inclination of the orbit of the moon to the plane of the ecliptic prevents this occurrence taking place so often; but whenever the moon passes the earth in an exact line with the sun, that is whenever the three bodies are in an exact line with each other, the moon is eclipsed.

Every eighteen years and ten or eleven days the order in which eclipses occur is the same as that of the previous eighteen years. It might therefore be imagined that a correct list of eclipses for eighteen years would be sufficient for all purposes; as by adding the ecliptic period as many times as required, the period of an eclipse might be known at any distance of time. This would be correct if every eclipse appeared under precisely the same circumstance as its corresponding eclipse in the preceding or following period; but this is not the case. An eclipse of the moon, which, in the year 565, for example, was of 6 digits, was in the year 583 of 7 digits, and in 601 nearly 8. In 908 the eclips became total, and it remained so for about twelve periods, or until the year 1088; this eclipse continued to diminish until the commencement of the fifteenth century, when it totally disappeared in the year 1413. In like manner an eclipse of the sun, which first appeared at the North Pole in June 1295, proceeded more southerly at each period. On the 27th August, 1367, it made its first appearance in the north of Europe; in 1439 it was visible all over Europe; in 1601, which was its nineteenth appearance, it was central in London; in 1818, on the 5th of May, it was visible in London, and was again nearly central in the same place on the 15th May, 1836. At its thirty-ninth appearance, August 10th, 1980, the moon's shadow will have passed the equator, and as the eclipse will take place nearly at midnight, it will be invisible in Europe, Africa, and Asia. At every subsequent period the eclipse will go more and more towards the south, until, finally, on the 30th September, 2665, which will be its seventy-eighth appearance, it will go off at the south pole of the earth, and disappear altogether.

## MISCELLANIES.

*Construction of Railways.*—At a late meeting of the institutions of Civil Engineers a conversation took place on the paper that had been read by Mr. Reynolds, at a previous Meeting on the form of rails and method of constructing Raiways. It was stated that there were evidently great advantages in the system of continuous bearing; and the combination of wood and iron, proposed by Mr. Reynolds, seemed well adapted in some respects to answer the proposed object. But a question might be raised respeating the angu-

Digitized by Google

lar form of the bearers. There were advantages in the facility with which the under sides of these bearers might have earth beaten under them, so as to restore any part which might have sunk; but the peculiar advantages assigned to this form, as affording the vertical support due to an encreased area, were not at once apparent. To this it was replied, that the rails on Chatmoss did not show and tendency to sink, and were, in the opinion of many who had been to see them, in a better condition, both as to level and wear, than the others which had been laid at the same time in the usual manner. Objections to the wood, from its liability to decay, were replied to, by stating that the wood having been boiled in tar, and allowed to cool in the tar, became impervious to moisture, and was, consequently, very little liable to decay.

*Products of American Forests.*—The value of skins, furs, ginseng, lumber, staves, bark, tar, pitch, rosin, and turpentine, and pot and pearl ashes, partly from the northern and partly from the southern states, which were formerly of much greater comparative importance in the trade of the country, now constitutes about one-thirteenth part of the whole value of the domestic exports, and amounts to 3,889,611 dollars. A large proportion of the trade in these articles, as well as in those of cod-fish and bread-stuffs, is carried on with the West Indies, Mexico, and South America. The skins and the furs go to Europe and Canton; the ginseng to Canton, but in less quantity than formerly, being, in 1828, but 91,164 dollars; and the pot and pearl ashes are sent to England and France.

*Products of the American Sea.*—The products of the whale, cod, mackerel, and herring fisheries, exported mostly from the northern states, amount to 1,693,980 dollars, being nearly a thirtieth part of the whole domestic export. Nearly one-half of this value consists of cod-fish, and more than one-third of the products of the whale fisheries.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Institution.* Finsbury Circus.—Monday, May 1, at 7 o'clock, H. Innes, esq., on the Sacred Poetry of Great Britain.

*London Mechanics' Institution,* Southampton-buildings, Chancery-lane.—Wednesday, May 3, at half-past eight, Mr. Cull, on Phrenology.—Friday, 5, Dr. Ritchie, on Optical Instruments, &c.

*Aldersgate-street Institution*—Wednesday, May 3 at eight, R. Addams, esq., on Dynamics.

*Western Literary and Scientific Institution,* 47, Leicester-square.—Thursday, May 4, at half-past eight, Mr. Stanhart, on Lithography.

*Eastern Athenæum,* Stepney Square.—Wednesday, May 3, at eight, N. F. Zaba, esq., on the Literature of Poland.

*Lambeth Literary and Scientific Institution.*—Tuesday, May 2, at half-past eight, W. Luking, esq., on Cometary Astronomy.

*Southwark Literary Society.*—Wednesday, May 3, F. Statham, esq., on Optics, at eight.

*Poplar Institution,* East India Road.—Tuesday, May 2, at eight, W. Chalklen, esq., on Roman History.

*Tower Street.*—Monday, May 1, at eight, Mr. Thomas, on the Origin and Progress of the Art of Printing.

*Bermondsey Mutual Instruction Society.*—Tuesday, May 2, at quarter past eight, Mr. H. W. Saffel, on Chemistry.

*Finsbury Mutual Instruction Society.*—Tuesday, May 2, at half past eight, Mr. White, on Hydrostatics.

## TO CORRESPONDENTS.

*To the Editor of the Penny Mechanic.*

*Contraction of Burnt Clay.*—Sir, In answer to your Correspondent who wishes to know the reason of clay contracting instead of expanding by heat, I would suggest that as clay is a powerful absorbent of moisture, and also that it is extremely difficult to deprive it of the moisture once imbibed, it is *probable* that the contraction is caused by the volatilization of the liquid. This assertion seems to be borne out by the fact, that on cooling it remains contracted, instead of returning to its former volume. If you think this is worthy of insertion in your valuable journal, you will oblige.—CHINA.

*Quill Making.*—Sir, if a description of the process termed "Dutching," which I think is the first a quill is subject to, will aid your Correspondent "C. D." in his inquiry, I will forward an illustration; but if he alludes to the yellow colour that quills are made to assume; that is effected by holding them for some time in boiling Linseed Oil.—W. CLEMENTS.

"M. N." We will insert his communication if he will send us a description of the action of the Paddle Wheel, and a clearer drawing.

"W. L. T. of Birmingham," can ascertain "the temperature of the earth at various depths below its surface in any latitude," by means of a thermometer. In latitude 22° he will find an uniform temperature a few feet below the surface: the same at other places.

"John Gregory." We are much obliged for the additional particulars and the drawing. We will not forget his request.

"F. R. I. A." Address "to the Secretary at the Southampton Coffee House, Southampton Buildings, Chancery Lane.

"W. J. B." should write to "the Doctor."

"Mr. Monday's" Safety Lamp shall be noticed in an early Number.

We shall be glad to receive a description of the process of Quill Making from MR. CLEMENTS.

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

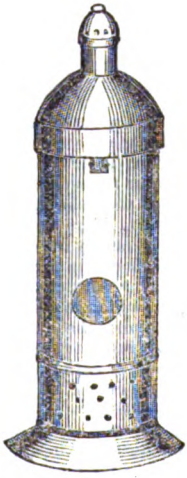
No. XXVIII.] SATURDAY, MAY 6, 1837. Vol. I.

## THE ROYAL MONGOLFIER.

## THE SAFETY LAMP.

Fig. 1.

Fig. 2.





Holloway Press: D. A. Doudney

Digitized by Google

## THE ROYAL MONGOLFIER.

*Celebration of the* PRINCESS VICTORIA'S *Birth-Day.*

THE 24th of the present month being the day appointed for the celebration of the termination of the Princess Victoria's minority; and, as it will be a general festival, we think we cannot acquaint our juvenile readers with a more pleasing mode of signifying their gratification at the important event, than by directing their attention to the Mongolfiers, or, Fire Balloons—of which, and the mode of inflation, we have given a sketch in our front page.

These balloons are constructed (from 7 to 25 feet in circumference) of various tinted tissue paper, with the word "VICTORIA" in large characters, and the Royal Arms, on different parts of them. They are inflated by means of a proportionate quantity of cotton attached to the orifice, which being saturated with spirits of wine, and ignited, causes the balloon to ascend, and remaining sometime in the air, affords a most interesting exhibition. The wrapper of each balloon contains a few familiar observations on the Arts and Sciences, adapted to the capacity of youth, which it would be well to commit to memory previous to the ascent of the Mongolfier; thus combining utility with amusement. To parents it will afford an opportunity of dictating a pleasing lesson, with the promise of an interesting reward.

A still evening, about sunset, is the best time for the display. The above may be obtained of Darton and Son, Holborn Hill, and most respectable Booksellers and Toymen.

## SAFTEY LAMP.

*To the Editor of the Penny Mechanic.*

SIR,—The following is a description of a Safety Lamp, for the use of persons working in coal mines, &c., which may be of service to some of your numerous readers, fig. 1, is a section of the whole, *a* is the interior of the lantern, *b* the lamp, *c* the burner which must be nearly in the centre, *d*, a piece of tube soldered in the lamp as near as possible to the burner to receive the smaller tube, *e*, which is soldered to the partition that supports the lamp, which is marked, *g*, *hh*, is a large tube also fastened to the partition, *i* is the interior of the tube filled with pieces of wire of one-eighth or three-sixteenths of an inch in thickness, pointed at each end, *k* is the bottom which must be made to open at *l*, to enable the wires to be cleaned if required, *m* is a handle fixed to the lamp for the purpose of removing it when it requires trimming, attached to which is a reflector, and in the front is a lens for making the light more powerful, *n* is the top of the lantern, in the centre of which is a tube filled with wire the same as the bottom, the lower ends resting on the circular piece of metal *o*, the top being covered by a cap having holes round the outside. Now it will be seen that to supply this lamp with fresh air, it must enter the lantern through the holes in the outside, pass under the tube and between the wires, and through the small tube, the upper end being close to the flame, the air will be consumed (whether inflammable or not) immediately on entering; the burnt air passing out at the top between the wires as on entering. Fig. 2 is the outside of the same. If, Sir, you consider this worth you notice, the insertion will oblige

Your obedient Servant,
F. MONDAY.

## UNHEALTHY TRADES.

[THE Editor of the "American Journal of the Franklin Institute" a short time back published the following interesting paper on this subject, in answer to the question "are there any trades so injurious to health, or so hazardous to morals, that they ought, for that reason, to be discouraged or abandoned?" Few persons, perhaps, will be disposed to dispute the conclusion at which he arrives, although we think it by no means necessary, in order to secure the comforts and luxuires we now enjoy, that so many of our fellow creatures should be compelled to pass a miserable and painful life, and die generally long before the ordinary time of other men. Therefore, although we agree with the writer that the comforts of the majority ought always to receive consideration before those of the minority, yet we see no reason whatever why the minority should be obliged to undergo all kinds of privation in order to secure the enjoyments of the other portion of society. In the cases referred to, there is every probability that in a few years time machinery will be constructed that will obviate the necessity of men, like the needle pointers, for instance, undertaking a business the pernicious effects of which are so well described by the writer. And when we know what has already been done for the miner, by the invention of the safety-lamp, we have every reason to hope that the perils to which he is now unfortunately so often still exposed, may

Digitized by Google

be provided against, if not entirely removed. The same effect we trust will be produced by machinery in the various other trades that are now so injurious to health, and so destructive of human life.]

When the question, "Are there any Trades so Injurious to Health, or so hazardous to Morals, that they ought, for that reason, to be discouraged or abandoned?" is propounded to an individual whose mind has not been schooled by habits of reflection, and there is presented to his notice some occupation or trade which is obviously injurious to health, or hazardous to morals, he will probably pronounce, at once, that it ought to be abolished by the interposition of the law. The philosopher and the moralist, however, who are in the habit not only of inquiring into the immediate relationships of every subject, but of tracing each to its remote affinities, will, in most cases, see cause to reverse this judgment. The question before us, will, I apprehend, be found, in most of its bearings, to be one of a very complex character. This must be apparent, when it is recollected, that the perfection of those arts from which civilized man derives so many of his highest intellectual and corporeal enjoyments, are dependent upon pursuits which form very remote links in the chain of events upon which civilization itself is dependent; events, however, so intimately catenated, that we may with much reason apply to them the idea of the poet, that if the connection is destroyed,

"Whichever link you strike,
Tenth, or ten-thousandth, breaks the chain alike."

The question, as propounded, is so latitudinarian in its terms, as to render it impossible, in the compass of such a report as ought to be delivered to the Lyceum, to present it in many of its bearings. I shall, consequently, be compelled to assign to it limits of my own choosing; although in so doing, I may be charged with acting something like the Grecian, who, having a house for sale, exhibited a single brick as a sample of its elegance and convenience.

The proportion of those trades and occupations which are unfavourable to health or hazardous to morals, is very large, when compared with the whole catalogue of those pursued by man. Some of these are intrinsically hurtful in both respects, whilst others are rendered so, principally, or entirely by the manner in which they are carried on, and the habits of those engaged in them. It seems necessary, however, to confine our inquiry to such as are intrinsically hurtful, as in the others, it is the habits which are to be condemned, and all will admit that these, when bad, ought to be discouraged and abandoned.

I have already remarked that the terms of the question are somewhat vague. I allude particularly to the words "discouraged or abandoned." If regulation or suppression is intended, this will refer the action to the legislative and executive authorities, and in this way I consider it as necessary to treat it; for if such things are to be attempted by individual exertions, the whole business of the world must merge in the formation of a thousand different societies, analogous in their organization and objects with that of the Temperance Society.

The business of the miner is, in numerous instances, extremely unfavourable to health, and that necessarily so; in proof of this position we will take an example from the mines of a common metal,—lead, in a place chosen at random, where there is nothing to render the business particularly hurtful. In a work written within a year or two, it is observed by its author, Mr. Thackrah, that at the small village of Arkendale, situated in a mining district in Yorkshire, England, there were then not fewer than thirty widows under thirty years of age, whose husbands had died of diseases of the lungs and other affections, brought on by the dampness of the mines, and the other hurtful circumstances attendant on the business in which they were engaged. Where there is so much early destruction of life, we must necessarily conclude, that a large proportion of those whose constitutions enable them to resist the fatal effects of their business for a longer period, must drag out existence in a state of extreme suffering. The picture of the suffering in these mines, however, would lose its colouring alongside those which might be drawn of that endured in the mines of quicksilver in Idria, of arsenic and cobalt in Germany, and of many, very many others in different countries. Were I to describe them, I must place before you such scenes of human suffering, as it would be extremely painful to narrate and to hear; I forbear, therefore, to bring them forward, not deeming them necessary to the sustaining of the position which it is my design to advocate.

Shall we pass laws for the purpose of preserving the health, and of saving the lives of those now employed in these mines? If so, we must ordain that they shall be closed up, and that the metals which they produce shall be no more used

Digitized by Google

in the arts. Let us suppose that quicksilver, one among the worst, was selected, and that the use of that metal alone was inhibited. What would then become of those mines of gold from which the precious metal cannot be obtained in any other way than by its amalgamation with mercury? All the arts which are dependant on the use of this metal, must be relinquished, and of these there are several of no small importance, and the relinquishment of which would involve very serious considerations. It may be doubted whether the ladies themselves, humane as they are, would ever consent to forego the employment of those ornamental and useful mirrors by which their charms are so often and so faithfully reflected. Admitting, however, that this sacrifice was made, and for the looking glass we had substituted plates of polished metal, or in default of these, the mirror of Narcissus, there would still remain unfulfilled the most important purpose to which quicksilver is now applied. Because thousands perish in the working of these mines, shall we, to save these, indirectly slay our tens of thousands, by depriving the physician of the use of that Sampson of medicine, mercury? A remedy, without which, his efforts to cure some of the most formidable diseases, would be altogether unavailing. Were I to pursue this part of our subject to its limits, I believe that, standing alone, it would suffice to convince any one of the utter futility of the attempt to legislate respecting, or in any other way to regulate, the pursuit of such a business as even that of digging for quicksilver.

Leaving one of the worst, we will inquire for a few minutes into some of the consequences resulting from our obtaining from the earth those substances which are among the most harmless, and the most useful productions of the mineral kingdom. Were we to visit the coal districts of England, we should find them abounding with widows and orphans, whose husbands and fathers have been blown to atoms, or scorched to death, by the explosions of the fire damps, a hundred at a time; or who have been killed by the choke damp, or drowned in the waters which sometimes make an irruption into these mines. We should, also, every where, meet the lame, and the halt, and the blind, who have merely escaped from a sudden death to drag out a miserable existence in pain, poverty, and want of every description. Shall we apply a remedy to these evils, and provide that, in the coal mines, there shall be no more accidents from carburetted hydrogen, carbonic acid, water, the falling in of roofs, or the giving way of ropes, chains, and ladders? But how shall we accomplish this? Why certainly in one way only; we must resolve to do without the coals; we must close the smelting furnaces of a nation; arrest every branch of manufacture, and at length put a final end to human misery, by allowing, in the first winter, the poor and the rich to freeze to death in one common mass, from the want of the only fuel which the country can supply.

The universal suffrage, I apprehend, would be against such a measure; at all events, when the toes and the fingers of those who sublimated, sentimental humanity had caused them to hesitate, were becoming frost-bitten, they would send in their adhesion, and admit that it would be best to let the colliers pursue their labours, and run their inevitable risks.

*(We will conclude the paper next week.)*

## THE STEAM ENGINE.

### NO. VIII.

THE Atmospheric Engine, described in Number 23, possessed several very great advantages over that of Savery's. It was not dangerous to use. The low pressure of the steam employed to work it rendered the bursting of the boiler almost an impossibility, except those who had to superintend the engine were very careless. Savery's engine on the contrary was always dangerous. The high pressure of the steam used, required the boilers to be exceedingly strong in order to prevent their bursting; and in consequence of the great heat required to produce steam of the necessary power, the engines were constantly out of repair. This was not the case with the atmospheric engine; and consequently they were much less expensive than Savery's, and far preferable. But the principal advantage of Newcomen's improvement was, that the working beam enabled the power of the engine to be applied to any kind of machinery; and to the generation of power there was no limit but the dimensions of the cylinder, and consequent diameter of the piston. It might from these circumstances be imagined that Newcomen and Cawley would at once have received the patronage their ingenuity deserved. But the patentees had many difficulties to overcome. We have before mentioned that they were not men of science. They were not mathematicians, and the want of knowledge of this kind prevented them taking that advantage of their invention that they would otherwise have been ena-

Digitized by Google

bled to do. "In 1711, the patentees made proposals to draw water from a mine at Griff in Warwickshire; but their scheme did not meet with any encouragement. In March 1712, through the acquaintance of a Mr. Potter, of Bromsgrove, in Worcestershire, Newcomen succeeded in getting a contract to draw water for a Mr. Back, of Wolverhampton, and being near Birmingham, Newcomen obtained the assistance of many ingenious mechanics of that place, who greatly improved the working of the engine.

The usefulness of the atmospheric engine depended on the rapidity with which the steam that was admitted into the cylinder to force up the piston, could be condensed. As in order to produce this effect it was always necessary to cool down the whole cylinder to a temperature below that of steam, it is evident that there must necessarily have been a great loss of time and fuel. For the steam could not be condensed quickly; not more than seven or eight strokes a minute could be made; after each condensation it was also necessary to raise the cylinder to the same temperature as the steam, before an effective stroke could be obtained. A means of remedying these evils to a great extent was discovered by accident. The piston rod was one day observed to make several strokes in succession with very great rapidity, and without the usual process of cooling the cylinder. Newcomen could not at first account for this, but on closely examining the cylinder, a small hole in it was discovered, through which it was found a jet of cold water had been injected into the interior. This at once condensed the steam, without materially reducing the temperature of the cylinder, and in a much shorter time than was required by the ordinary method of producing that effect. Newcomen took advantage of the hint thus afforded him, and immediately altered the machinery of the engine, so that instead of cold water being allowed to fill the space between the two cylinders, as represented in the engraving in Number 23, the water was injected into the interior of the steam cylinder.

The manner in which the engine worked when thus altered was as follows. Steam having been generated in the boiler, below the cylinder, was admitted into it through a connecting pipe. The force of the steam drove up the piston, and a cock was then opened which allowed water from a cistern above the cylinder, to issue from a pipe in the form of a jet; this condensed the steam in the cylinder into water, and produced a vacuum. The atmosphere pressing with a force of nearly 15 lbs. on every square inch of the piston accordingly drove it down, with a force proportionate to its diameter. The larger the piston, of course the greater was the power generated by this means.

Although the steam-engine thus constructed was greatly superior to any that had previously been invented, there were many serious inconveniences attending its working. Persons were obliged to be in constant attendance to open and shut the cocks of the injection pipe, and unless this was effected at the proper time, the machinery might be severely injured. As however the operation was purely mechanical, and only required proper attention, it was generally intrusted to boys. One of these, who without any good reason, has generally been spoken of as a very idle fellow, and blamed for his indolence, rather than applauded for his ingenuity, contrived a means by which the engine should open and shut the cocks itself. He added a catch, or scoggan, as be called it, to the cocks, and the piston in rising and falling opened and shut the cocks by this means at the exact moment required. Humphrey Potter, who is not known for having made any other invention in mechanics, has had his name preserved to posterity for this. Although idleness is generally asserted to have been the cause of his exerting his ingenuity to so useful a purpose, it is rather unfair to assume this, when the merit of his invention, and consequently his ingenuity, is really considered. From the regularity and certainty with which the steam could now be condensed, the engine that previously could not make more than seven or eight strokes a minute, was enabled to make fifteen or sixteen.

The contrivance of Humphrey Potter directed the attention of an ingenious engineer to the subject. In 1718 Mr. Henry Beighton erected an engine, in which all the cocks were opened and shut by a piece of mechanism called by him "hand gear;" a rod, suspended from the beam of the engine, had a number of pins projecting from it, which acted upon a number of levers, and thus effected what had previously been accomplished by hand, or by Potter's contrivance. By these means the steam-engine was brought to a state of comparative perfection, and with some few improvements that were made in the hand gear; and also in the construction of the other parts of the machinery by Smeaton, it was in this state that the great James Watt found it, when his attention was first directed to the subject.

Digitized by Google

## BIOGRAPHICAL SKETCHES.

### JAMES BRINDLEY.

*(Concluded from page 213.)*

The most experienced engineers, upon former systems, were amazed and confounded at his projects of aqueduct bridges over navigable rivers, mounds across deep valleys, and subterraneous tunnels; nor could they believe in the practicability of some of these schemes, till they saw them effected. Nothing can resist true genius. Irresistible must have been that of him whose "ideas," while in the execution of these things, are allowed to have been "all his own;" and when the minutest, as well as the greatest of the expedients he employed, bore the stamp of originality.

His whole time was engrossed in devising means for advancing the inland commerce of his country, by projecting and perfecting those more modern rivers which are generally known under the designation of canals; an occupation so exclusively interesting to him, that when he was asked before a committee of the House of Commons, having thrown out some contemptuous observations respecting the worth of rivers, what he conceived they were created for? he immediately answered—"To feed navigable canals." Nothing could more aptly have characterised the genius of Brindley.

After the successful execution of the Duke of Bridgewater's Canal to the Mersey, Mr. Brindley was employed in the revived project of carrying a canal from that river to the Trent, through the counties of Chester and Stafford.

During the progress of this undertaking which was begun in the year 1766, he was called upon to exert all the resources of his genius, particularly as to the hill of Hare-Castle, which was only to be passed by a tunnel of great length, bored through strata of different consistency, and some of them mere quicksand. Whilst this canal was forwarding, its conductor was entrusted with the superintendence of a canal from the Grand Trunk, near Haywood, in Staffordshire, to the river Severn, near Bewdley; which was finished in 1772, and by means of which the port of Bristol obtained a communication with Liverpool. Indeed, there was scarcely any design on the subject of canal navigation, towards the close of his career, on which he was not consulted, and the plan of which he did not either entirely form, or, at least, revise and improve. At length however he fell into a kind of chronic fever, which, continuing some years with but little intermission, finally terminated his life, September the 27th, 1772, in the 56th year of his age.

Brindley is described, "in appearance and manners, as well as acquirements, to have been a mere peasant. Unlettered, and rude in speech, it was easier for him to devise means for executing a design than to communicate his ideas concerning it to others. His ideas were his own. Not having those of other men to assist him, whenever a point of difficulty in contrivance occurred, it was his custom to retire to his bed, where, in perfect solitude, he would lie, one, two, or three days, pondering the subject in his mind, till the requisite expedient had presented itself. This is that true inspiration which men of original genius, in every walk, are actuated by, when, from the operation of the mind, acting upon itself, without the intrusion of foreign notions, they create and invent. Originality like his, however, had its disadvantages. Accordingly, in his calculations of the powers of machines he followed a plan peculiar to himself; but, indeed, the only one he could follow without instruction in the rules of art. He would work the question sometimes in his head, and then set down the result in figures; then taking it up in this stage, he would proceed by a mental operation to another result; and thus he would go on by stages, till the whole was finished, making use of figures only to mark the several results of his operations. But though, by the wonderful powers of native genius, he was thus enabled to get over his want of artificial method to a certain degree; yet there is no doubt that, when his concerns became extremely complicated, with accounts of various kinds to keep, and calculations of all sorts to form, he could not avoid that perplexity and embarrassment which a readiness in the processes carried on by pen and paper can alone obviate. His estimates of expenses have generally proved wide of reality; and he seems to have been better qualified to have been the contriver than the manager of a great design. Though defective in such respects, a remarkably retentive memory was one of the essential qualities which Mr. Brindley brought to his mental operations. This enabled him to execute all the parts of the most complex machine in due order, without any help of models or drawings, provided he had once settled the whole plan in his mind.

## MECHANICS' LIBRARY.

*The Engineers' and Mechanics' Encyclopædia.* By Luke Hebert, C. E. Kelly.

THE plan of this work is exceedingly good,

Digitized by Google

and the class of persons for whom it is more particularly intended will find it a useful assistant in their different professions. This Encyclopædia is not, however, of an exclusive character; it is an epitome of practical science, and will amuse and instruct those who may not require for their business the information it contains as well as those who do. The articles are very clearly written, and will be as easily understood by the "mechanic" as by the "engineer." Indeed, we are not acquainted with a work which, on the whole, we would sooner recommend to the notice of our readers for a lucid explanation of the useful arts than "the Engineers' and Mechanics' Encyclopædia." From its title, we anticipated that it would be more technical than it is; and its not being so may, by some persons perhaps, be considered a fault. It may be thought that it is written too much for the general reader. From a careful examination of the work, we are, however, inclined to think that the grounds for such a charge are more apparent than real. The tables contained in the work will be found of much service by the practical man; and the articles on railways, clock and watch-making, printing, gas-lighting, and the steam-engine; and also most of those on the different branches of manufacture and the arts, while they cannot fail to interest the general reader, at the same time contain much valuable information that will prove especially useful to the workman. A greater space might have been advantageously allowed for some of the articles connected with chemical science. We wish the paper on chimistry itself had been longer; what is said, however, is very well said. The descriptions of the processes of brewing and dyeing deserve particular notice; and the papers on the silk and cotton manufactures contain much curious detail. The work is very neatly printed, and there is a profusion of wood-cut illustrations, which greatly enhance the value of all books, but more particularly such as the present.

## THE STEAM PLOUGH.

*To the Editor of the Penny Mechanic.*

Sir,—In Number 22, of your useful little miscellany, a paragraph appeared stating that the Highland and Agricultural Society of Scotland, had offered a premium of £500 for the first successful application of steam power to the cultivation of the soil, and also that from that circumstance you presumed the steam plough invented by Mr. Heachcoat, M. P., had not proved successful. A few days ago an article was published in the newspapers, giving an account of the exhibition of the powers of the plough before a deputation of the society above mentioned; but it does not state whether or not the deputation were satisfied with it. When the plough was first exhibited in June, last year, there appeared to be scarcely a doubt of its complete applicability to agricultural purposes. Perhaps you, or one of your correspondents, can give a satisfactory answer, and oblige

Sir, Yours, &c.

J. F. S.

## EXPLOSIONS OF GAS.

Accidents of this kind were at one time more frequent than they are at present, but now they occur much oftener than many persons suppose. The following directions how to act whenever an escape of gas from any of the pipes is discovered, may not therefore be without use.

When a strong smell of gas is perceived, a leaking from some cause must have taken place; and every door and window in the room which may contain it, should be opened, that the mixture of gas and atmospheric air may escape. Neither lighted candle nor any other inflamed substance should be introduced, or allowed to approach the place, until the whole of the mixture of common air and gas is completely expelled, and the room thoroughly ventilated.—It cannot be too strongly impressed upon every person who is in the practice of using gas-lights, that the gas is not explosive of itself, in the state the public receive it from the gas works; and to render it capable of exploding, it requires to be mixed in various proportions of from five portions of coal gas to twelve of atmospheric air; and when mixed in any of these proportions, it will not explode unless flame come into contact with it. Oil-gas is rendered explosive when mixed with about three and a half or four parts of common air, and its explosive property increases till the mixture arrives at about nine or ten parts of atmospheric air, which is generally its highest point; but as the atmospheric air mixes with it in larger quantities, the explosive power gradually becomes less, till it totally ceases. Whenever, therefore, any escape of the gas may be discovered to have taken place, the proper recourse is ventilation without delay, and preventing the introduction of a lighted candle or any other kind of flame where the circumstance may occur. Proper ventilation, and keeping away flame, will infallibly tend to prevent ac-

Digitized by Google

cidents from explosion. These are facts which every one should know, and then he may use gas-lights not only without apprehension, but with the most perfect satisfaction.

## MISCELLANIES.

*Decay in Timber.*—At a meeting of the Institute of civil Engineers held 14th March last, some remarks having been made on the decay of Timber in contact with Stone, it was stated by a member that he had recently examined a bridge, the only decayed parts of which were those built into the stone. That the ends of the timber being charred, or placed in an iron socket, however thin, was a certain preservative; but that wood in contact with stone invariably decays in a very short time. A member stated, that in a situation with which he was acquainted, the wood near the ground was seized by the dry rot in a very short time. This was prevented by inserting the door-posts, &c. into iron boots sixteen or eighteen inches deep. It was suggested that the system of fronting, by which wood is surrounded with large quantities of moisture, must contribute to the early decay of bond timber, and that bond iron was consequently much used. This was said not to be the case in the buildings at Manchester; and the exception was attributed to the high temperature and consequent dry state at which the buildings are there maintained. The average temperature of the manufactories was stated to be sixty degrees Fah. Some remarks were then made on the system of building which was adopted at Manchester.

*Polishing Powder.* — Certain of the French manufacturers of polishing powder use in their manufacture scraps of old iron, which they put into a tub and cause to rust quickly by sprinkling with water. When a sufficient quantity of rust has thus been formed, it is collected by washing, and after allowing it to settle, it is dried and calcined in a crucible. The longer the calcination is continued, the more the oxide approaches to a violet hue, and the harder its grain. At a very high temperature the oxide is partly reduced, its colour becomes more gray, and the grain is too hard for polishing. The red oxide serves for polishing gold and silver, the violet oxide is fit for polishing steel. When taken out of the crucible it is first triturated, and then levigated, in order to collect the finest parts.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton buildings, Chancery-lane. — Wednesday, May 10, Mr. Brown on the Love of Praise.—Friday, 12th, Mr. T. Phillips, on National Melodies, both at half-past eight.

*Aldersgate-street Institution.*—Wednesday, May 10, R, Adams, esq., on Dynamics, at eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, May 11, at half-past eight, Mr. Fry, on the Character and Writings of Milton.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge road.—Tuesday, May 9, at half-past eight, W. Lukeing, esq., on Light and Colour.

*Poplar Institution*, East India Road —Tuesday, May 9, at eight, William Chalklen, esq., on Roman History.

*Society of Arts*, Adelphi.—Monday, May 8, at eight, J. Henming, esq., on the Art of Embossing Paper.

*Eastern Literary and Scientific Institution*, 88, Hackney-road,—Tuesday, May 9, at eight, H. Innes, esq., on English Literature.

*Mutual Instruction Society*, Great Tower-street.—Monday, May 8, at eight o'clock, Mr. D. Saull, esq., on Geology.

*Kentish Town Mutual Instruction Society.*—Monday, May 8, at half-past eight, J. T. Hawkins, esq., on the Production of Wealth.

*Bermondsey Mutual Instruction Society.*—Monday, May 8, at a quarter-past eight, Mr. Saffell, on Chimistry.

*Finsbury Mutual Instruction Society.*—Tuesday, May 9, at half-past eight, Mr. White, on Hydrostatics.

## TO CORRESPONDENTS.

"A. B." and his friends shall have their wish attended to.

"Snubby Gong's" humourous epistle has come to hand. We shall be glad to receive some effusion of his wit of a more *scientific* character.

"C. Rolt." We cannot promise to insert the article sent us, but we are much obliged for it, and the drawing, although gasometers of a similar description were invented many years since.

"A Mechanic," may probably obtain a pecuniary reward for his ingenuity by sending his model or drawing, and a description of it, to the Society of Arts, Adelphi.

"H. Bardsley" who wishes to know "the cost and manner of taking out a Patent," will find some information on the subject in our back Numbers. It will be necessary for him to employ an attorney.

"Mr. J. Gregory's" drawing of an Improved Balloon and the description shall appear if possible next week.

Received "D. M." "X. X." "A Young Mechanic," and "Sophos."

"An Old Reader," who complains that our type is, *now* almost too small for him to read conveniently, ought to patronize a spectacle maker.

Several Queries next week.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXIX.] SATURDAY, MAY 13, 1837. Vol. I.

## IMPROVED BALLOON.

Fig. 1.

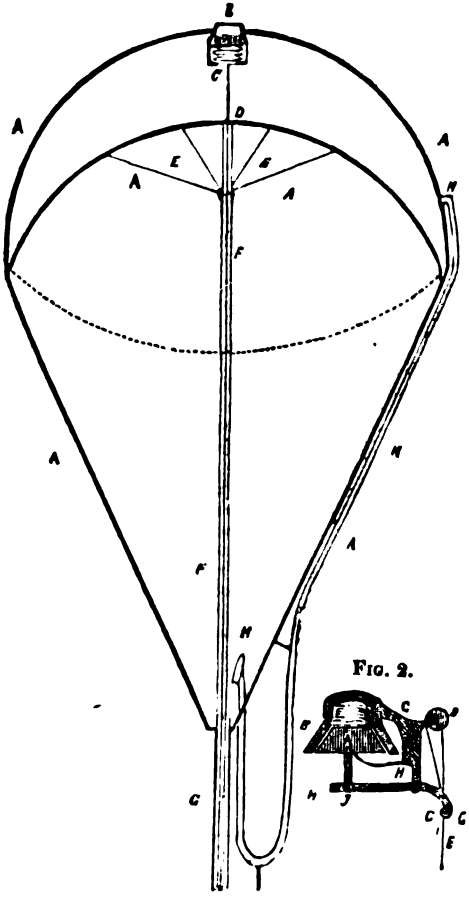



Fig. 2.






Holloway Press: D. A. Doudney.

Digitized by Google

## IMPROVED BALLOON.

*To the Editor of the* PENNY MECHANIC.

SIR,—No doubt your readers are quite aware that the expansion of gas in balloons is owing to the decreased pressure of the atmosphere; for my part I cannot see the least utility for ascending so high but just merely to gratify curiosity, for no benefit can arise from it, but great inconvenience, if aerostation is ever applied to a useful purpose, which I feel confident it can by the application of my invention described in Number 11 of the PENNY MECHANIC. Nothing would be more distant from the aeronaut's thoughts than that of ascending to a great altitude with the exception of getting above a storm or contrary wind, under circumstances which cannot be avoided at all times, and though you may keep as near the earth as possible, still your gas will expand; to prevent this in a measure, if not entirely, I propose to use artificial pressure; see fig. 1. The action of this arrangement will be as follows, when the balloon is inflated it will be as represented; gas occupying the whole interior. Upon finding the gas expand, the aeronaut has only to draw down the partition A, A, thereby condensing the gas in the lower department, at the same time allowing space for expansion in the upper: if that expands too much you open the valve by the cord *d*, passing through the pipe *f f*, which is used as a rope to draw down the partition. But to prevent, on the other hand, your condensing the gas too much, and the danger of bursting this is obviated by the pipe *g*, being introduced at the orifice and passed under two inches and a half of water, thus acting as a safety-valve in a boiler; for your silk will bear 162 lbs. pressure per square yard, and you counterpoise that by using three and a quarter inches of water, so by only using two and a half inches, bursting is almost impossible. When it does blow off you have only to open a stop-cock fixed in the pipe *h*, *h*, *h*, *h*, in the car, and thus allow the gas to fill the upper department of the balloon. If this is worthy of being inserted in your interesting work, I shall feel obliged.

I am, Sir,
Yours truly,
J. GREGORY.

EXPLANATION OF ENGRAVING.

Fig. 1, *a*, *a*, *a*, *a*, the balloon A, A, an internal partition composed of Mackintosh's cloth, fixed firmly to the exterior covering, B is the valve, *b* is the valve plug, ground in its seat air tight, and kept in its place by the spiral spring, *c d* is the cord which opens the valve, and which passes through the leathern pipe *f f*, and the cord passes the end of the pipe, *g* and dips three and a half inches under water, which would equal the condensation of 162 lbs. per square yard, and thus act as a safety-valve, *h*, *h*, *h*, *h* is a leathern pipe coming from above the partition A A, passing down the exterior of the balloon into the car, where there is a valve inserted, and into the lower part of the balloon as represented.

Fig. 2, is another discription of valve of which a vertical section is given, *a* is the valve plug, *b* the valve, *c* a stay to which the pulley *d* is fixed, also the steel-yard *g g*, to which the cord *e* is fastened and passed over the pulley, by pulling which cord the valve is opened, *f* a rod from the plug to which the steel-yard is attached, *h* is a strong spring pressing the valve-plug in its place, the axis of the yard is at *g*; no doubt your numerous readers will clearly understand the action of this valve.

## PECULIAR PHENOMENON CONNECTED WITH RESPIRATION.

AT one of the scientific meetings at the apartments of His Royal Highness the President of the Royal Society, whilst speaking of certain men, who, by means of peculiar apparatus for breathing, could walk about at the bottom of waters, and also of the pearl fishers; Sir Graves C. Haughton described to me an observation he had made, by the application of which a man could hold his breath about twice as long as under ordinary circumstances. It is as follows:—If a person inspire deeply, he will be able immediately after to hold breath for a time, varying with his health, and also very much with the state of exertion or repose in which he may be at the instant. A man, during an active walk, may not be able to cease from breathing for more than half a minute, who, after a period of rest on a chair or in bed, may refrain for a minute or a minute and a half, or even two minutes. But if that person will prepare himself by breathing in a manner deep, hard, and quick (as he would naturally do after running), and ceasing that operation with his lungs full of air, then hold his breath as long as he is able, he will find, that the time during which he can remain without breathing, will be double, or even more than double the former, other circumstances being the same. I hope that I have here stated Sir Graves C. Haughton's communication to

Digitized by Google

me correctly; at all events, whilst confirming his observation by personal experience, I found the results to be as above.

Whilst thus preparing myself, I always find that certain feelings come on, resembling, in a slight degree, those produced by breathing a small dose of nitrous oxide; slight dizziness and confusion in the head are at last produced; but on ceasing to breathe, the feeling gradually goes off, no inconvenience results from it either at the time or afterwards, and I can hold my breath comfortably for a minute and a quarter, or a minute and a half, walking briskly about in the mean time.

Now this effect may be rendered exceedingly valuable. There are many occasions on which a person who can hold breath for a minute or two minutes, might save the life of another. If, in a brewer's fermenting vat, or an opened cesspool, one man sinks senseless and helpless, from breathing the unsuspected noxious atmosphere within, another man of cool mind, would, by means of this mode of preparation, which requires nothing but what is always at hand, have abundant time, in most cases, to descend by the ladder or the bucket, and rescue the sufferer without any risk on his own part. If a chamber were on fire, the difference in the help which could be given to any one within it by a person thus prepared, and another who goes in, perhaps, with lungs partially exhausted, and who, if he inhale any portion of the empyreumatic vapours of the atmosphere, is stimulated to inspire more rapidly, and is therefore urged to instant retreat into fresh air, is so great, that no one who has noticed what can be done in a minute or in two minutes of time, can doubt the value of the preparation under such circumstances, even though from want of practice, and from hurry and alarm, it may be very imperfectly made. In cases of drowning, also, a diver may find his powers of giving aid wonderfully increased by taking advantage of Sir Graves Haughton's fact.

I have myself had occasion to go more than once or twice into places with atmospheres rendered bad by carbonic acid, sulphuretted hydrogen, or combustion; and I feel how much I should have valued at such times the knowledge of the fact above stated. Hoping, therefore, that it may be useful, I will add one or two precautions to be borne in mind by those who desire to apply it.

Avoid all unnecessary action, for activity exhausts the air in the lungs of its vital principle more quickly, and charges it with bad matter. Go collectedly, coolly, and quietly to the spot where help is required; do no more than is needful, leaving what can be done by those who are in a safe atmosphere (as the hauling up of a senseless body, for example,) for them to do. Take the precautions usual in cases of danger, in addition to the one now recommended. Thus, in a case of choke-damp, as in a brewer's vat, hold the head as high as may be; in a case of fire in a room, keep it as low down as possible. If a rope is at hand, by all means let it be fastened to the person who is giving help, that he may be succoured if he should venture too far. It is astonishing how many deaths happen in succession in cesspools, and similar cases, for want of this precaution. It is hardly needful to say, do not try to breathe the air of the place where help is required. Yet many persons fall in consequence of forgetting this precaution. If the temptation to breathe be at all given way to, the necessity increases, and the helper himself is greatly endangered. Resist the tendency and retreat in time. Be careful to commence giving aid with the lungs full of air, not empty. It may seem folly to urge this precaution, but I have found so many persons, who, on trying the experiment on which the whole is based, have concluded the preparation by closing the mouth and nostrils after an expiration, that I am sure the precaution requires to be borne in mind.

I have thought it quite needless to refer to the manner in which the preparation enables a person to increase so considerably the time during which he may suspend the operation of breathing. It consists, of course, chiefly in laying up for the time, in the cells of the lungs, a store of that vital principle which is so essential to life. Those who are not aware of the state of the air in the lungs during ordinary respiration, and its great difference from that of the atmosphere, may obtain a clearer notion from the following experiment:—Fill a pint or quart jar with water over the pneumatic trough, and with a piece of tube and a forced expiration, throw the air from the lungs in their ordinary state into the jar; it will be found, that a lighted taper put into that air will be immediately extinguished.

A very curious fact connected with the time of holding the breath was observed by Mr. Brunel, jun., and has, I think, never been published. After the river had broken into the tunnel at Rotherhithe, Mr. Brunel descended with a companion (Mr. Gravatt, I think,) in a diving-bell, to examine the place: at the depth of about thirty feet of water, the bell touched

Digitized by Google

the bottom of the river, and was over the hole, covering it, but too large to pass into it. Mr. Brunel, after attaching a rope to himself, inspired deeply, and sunk, or was lowered through the water, in the hole, that he might feel the frames with his feet, and gain further knowledge, if possible, of the nature of the leak. He remained so long beneath without giving any signal, that his companion, alarmed, drew him up before he desired; and then it was found, that either of them could remain about twice as long under water, going into it from the diving-bell at that depth, as they could under ordinary circumstances.

This was supposed to be accounted for, at the time, by the circumstance, that at the depth of thirty-feet, the atmosphere was of double pressure, and that the lungs, therefore, held twice as much air as they could do under common circumstances. It is, however, quite evident that another advantageous circumstance must have occurred, and that the air in the lungs was also better in quality than it would have been at the surface of the river, as well as denser; for supposing the deterioration by breathing to continue the same for the same time, it is clear, that every inspiration passed into the lungs twice as much pure air as would have entered under common circumstances: the injured air must, therefore, have been removed more rapidly, and the quality of that at any one time in the lungs must have risen in consequence. When to this is added the effect of double quantity, it fully accounts for the increased time of holding the breath; and had the effect of the mode of preparation now described been also added, it is probable that the time would have appeared astonishingly increased.—*Professor Faraday.*

## UNHEALTHY TRADES.

### SECOND ARTICLE.

Leaving the miners to those diseases and accidents to which their occupations necessarily subject them, because, for the purpose of continuing the blessings of civilization itself, we must obtain the metallic treasures of the earth, and the coal which is necessary to smelt them, let us make some inquiry into the effects of certain manufactures of the metals, after they have been brought into their regular state; in doing this, that one shall be chosen which does not possess any poisonous property, but which, in nearly all its combinations, is calculated to give tone to the animal system, whilst it, at the same time, forms the basis upon which the whole superstructure of the fine and useful arts is directly, or indirectly, sustained. This metal, you are all aware, is iron.

Without offering any great act of violence to the subject, we might, in speaking of this metal, introduce an inquiry into the remote effects of certain arts and trades; not upon the individuals who are the manufacturers of particular instruments, but upon those for, or against, whom, such are to be employed. The making of great, and of small guns, of pistols, of swords, in all their numerous varieties, of pikes, dirks, &c. &c. has, it is true, no remarkable injurious effects upon the persons who are thus employed, but, after they leave their hands, what myriads of the human race are cut off by them, whilst in the full possession of health, and in the prime of life. To such an inquiry, I am aware that it might be replied that nations and individuals will fight, and destroy each other, and that if deprived of the present more elegant means of doing so, they would still satisfy the noble calls of patriotism, the lust for spoil, and the promptings of ambition, by returning to the use of the sling, the bow, the war club, and the other rude modes adopted by our remote ancestors, and still pursued by impolite communities. Admitting this as an answer, it is much to be apprehended that one of a similar character, and equal in force, might be urged against any scheme, the object of which is to prohibit any trade or calling for the sake of those directly employed in it, as it would be necessary in this case to pursue the effects of the prohibition in its indirect as well as its direct bearings.

Leaving these naughty guns and swords to perform their respective offices, in the hands of those who are commissioned to "burn, sink, and destroy," allow me to direct your attention to those little spears which are never supposed to thirst for life, but whose worst acts are, to occasionally puncture a lady's finger, and to stain a cambric handkerchief. If we examine into the circumstances attending the production of that very harmless article, we shall find that between the period when the steel of which it is made was formed into wire, and that in which, as a finished needle, it is ready to be nimbly plied by the fair hand of industry and beauty, it has committed the most appalling ravages.

We have here taken a manufacture of very great extent, and giving employment to many thousand workmen. Of the persons engaged in the pointing of needles, very few indeed reach the age of forty

Digitized by Google

years, by far the greater number dying under that of thirty-two. The fine particles of steel which are ground off, are so light as to float in the air, and are so copiously deposited upon the mouth and nostrils as completely to blacken them; much irritation is produced by them in the lining membrane of the nose, and at first a copious mucous discharge is produced from it; but afterwards, the irritability of the parts is exhausted, and they become perfectly dry. The trachea, or windpipe, is next affected; respiration becomes difficult, and an habitual, exhausting cough is produced. Soon, nearly all the animal functions are disturbed, the digestive organs refuse to perform their offices, and the lungs, in particular, become the main seat of that total derangement of the whole system which must soon terminate in death. To find a man who has followed this trade for twenty years, is almost impossible.

I have introduced the pointing of needles as an example of the deleterious effects of the fine dust of steel, but the like evils are experienced in the making of a great number of other instruments of iron as well as of steel. Forks, for example, are finished by what is called dry grinding; that is, by grinding them upon a stone without water. Numerous utensils, also, of cast iron, when finished on the dry stone, or by fine files, give out a dust producing all the effects which I have described, and in an equal degree. To put a youth to these businesses, therefore, is to bespeak for him an early grave; yet society wants, and must have the articles, and there is no more difficuliy in inducing men to follow these trades than there is in enlisting them for the purpose of being killed, *secundem artem*, in the army or the navy; especially if they are to receive a few pence per diem more for this, than for some other species of labour.

Humanity has asked the question, Is there no means of preventing or lessening this evil? and ingenuity has devised a method of accomplishing the object, which it was believed would be effectual. A Mr. Abraham invented what was called a magnetic mouth-piece, to be used by the needle pointers, and dry grinders. This consisted of a considerable number of small magnets connected together by a common frame. The magnets were placed within a small distance of each other, and formed a kind of lattice-work; when these were strapped upon the face, the air which entered the mouth and nostrils must pass between them, and the ferruginous particles would consequently be attracted by, and adhere to the magnets. As might have been foretold, however, without the gift of prophecy, those for whose use they were intended would not wear them. Several causes combined to prevent their doing so, either of which would have been sufficient to govern the conduct of persons such as we are speaking of; these magnets were costly, and as they must frequently be taken off to be cleaned, they were very troublesome: but, worse than this, they were very ugly, and, worst of all, they excited the laugh, and the jeers of the shopmates of those who wore them. If the philosopher can scarcely scorn the world's dread laugh, he must know but little indeed of human nature who would expect better from the class of men who grind forks and point needles. I might go on and write a volume without danger of exhausting this subject; but I am not aware that there could be found more apt illustrations than those derived from some of the most necessary trades, most extensively pursued, and most destructive to the health and lives of those by whom they are pursued. In a despotic government, where human life is held cheap, a tyrant may compel an individual perhaps to wear an iron mask, without offering a reason why; but in a free government, where the life of every citizen ought to be accounted of inestimable value, the only mode of inducing a man to wear one for his own benefit, as well as to do many other desirable and proper things, is to give to him that degree of education which shall elevate him in his own opinion, and induce him to act from motives more worthy of his intellectual nature than those which usually govern persons in walks of life accounted much more exalted than that of the great body of workmen in our manufactories: this is the only remedy upon which I can found any hope; but, were I standing upon the threshold of life, just about to enter upon its duties, and possessing in the commencement of my career the benefit of the few observations which I have made, the little truth I have gleaned in the years which I have numbered, I should even then consider the hope as Utopian that I should live to witness the dawn of such a state of things in the humbler walks of life; for, warmly as I now feel in favour of a system of universal education, and great as I believe the benefits which are to be derived from it, I do not entertain a hope that by any effort, merely human, the great body of any community can be so far elevated above the level at which they now stand, as to induce them to act the philosopher in cases of this description. At all events I am fully of opinion

Digitized by Google

that so far as governments are conncerned in the regulation of trades and callings, they ought to be, as they generally have been, confined in their action to the prevention of nuisances; that artisans and manufacturers should be allowed to pursue their own business in their own way; and that "Laninez nous faire," should be their motto.

## PHILOSOPHICAL JOURNALS.

*Edinburgh New Philosophical Journal, No. XLIV.*

THE Scientific Journals are published so very expensively that it is not often the practical man can avail himself of the information they contain, although it is frequently well calculated to assist him in his profession. We shall endeavour to remedy this as far as we can, by giving an analysis of the works as they are published. By this means we hope not only to assist our readers, but also to promote the circulation of the journals which are generally well-conducted and deserving of patronage.

The present number of the Edinburgh New Philosophical Journal contains many papers that will well repay an attentive perusal. The first article, by Mr. Sang, giving an account of an improvement in the construction of Wollaston's Goniometer, and for which the Scotch Society of Arts have awarded him the honorary silver medal, appears likely to be of service in advancing the science of Crystallography. A paper on the "Mineral Springs of Ireland," is concluded; it gives a very interesting account of the phenomena many of them present, and will afford the naturalist many subjects for pleasing speculation. Dr. Bone also continues an article from the last number on the Geography and Geology of Northern and Central Turkey. The present article is devoted to Geology, and the profsssors of the science will find it exceedingly interesting. It determines, we think, satisfactorily, several doubtful questions respecting the geological structure of the country. One of the most interesting papers, however, is that contributed by Mr. Van Hoff, "On the Origin of Meteoric Stones, and more especially on the views entertained on the subject by Berzelius." We have in a former number given the opinion of that celebrated chemist on the subject. There have been three theories advanced in order to account for the appearance of meteoric stones. The *first* supposes that they are either the fragments of shattered planets, or themselves small planetary bodies, which, floating and revolving in space, descend to the earth's surface when they come within reach of the attraction of our globe; or that they are accumulations of loose matter, the original material from which planets were formed. The *second* theory supposes that they are masses ejected from the moon; this is supported by Berzelius. The *third* is that they are of atmospheric origin; that is, that they have been *formed* in the earth's atmosphere from gaseous substances belonging to itself. Van Hoff is inclined to suppose the latter theory, although not entirely, and he adduces many curious observations in support of his views. It appears that in every fall of a meteoric stone, and at the time when the falling body is still at a very considerable height above the surface of the earth—a height amounting probably to many miles—a very loud momentary explosion is heard, like the report of thunder, or a crackling noise, and which is very distinctly audible at great distances. Now this momentary explosion is least easily explained by the idea of the lunar origin of meteoric stones. If such a mass as a detached fragment of rock from the moon fell towards the earth, what could produce on it a momentary violent effect in a region where the earth's atmosphere—if indeed it extends so far—must be so attenuated, that it may almost be compared to empty space? Why there ensues an apparently tremendous explosion in that region, and not in the denser portion of the atmosphere, where the reaction of the latter on the penetrating solid bodies must be most powerful? Another circumstance deserving notice is, that while the meteoric stones themselves are generally small masses, the size of the fire-balls, which accompany their descent, is much larger than they could appear if the fallen masses had only the same dimensions at a considerable height above the earth that they have when upon it. The difference between the size of the fire-balls and that of the solid masses which have fallen from them, amounts sometimes to perhaps a hundred thousand times. From these and other circumstances attending the fall of these phenomena; from the evolution of light; and from the peculiar constitution of the meteoric stones, the writer of the article is led rather to favour the hypothesis that at the time when the explosion and evolution of light occur in a falling meteor, a great chemico-physical operation takes place, which is not merely the accompaniment of the fall of a solid body, or the effect of that fall, *but which forms a new body from the original elements*, and that this new body is actually the falling me-

Digitized by Google

teoric stone. Yet Van Hoff does not think this theory quite sufficient to account for the phenomenon, but he conceives the stones are newly formed from incoherent and probably gaseous materials, by a "great physico-chemical process." How this opinion can be reconciled with the theory of their lunar formation, which he appears to support in other parts of his paper, we are at a loss to understand. The article, however, is well deserving attention. The meteorologist will find several other papers on his science. A description is given of a new anemometer, by which the most minute changes in the force or velocity of the wind, or current of air, may be measured. It resembles a small gasometer like those used in gas-houses. A bent tube rises into an upright cylinder, enclosed in another containing water; the tube rises above the water, in the inside, and the other end, on the outside, is continued some height. Any change in the pressure of the atmosphere will of course affect the air contained within the cylinder, which will accordingly rise or fall in the water according to circumstances. The cylinder being connected with an axis, by means of a rope, its rising or falling is registered; and by this means the force and velocity of the wind may be ascertained. There is likewise "an account of some improved meteorological instruments," by Dr. Trail, which is now for the first time published. The physiologist also will find several interesting papers; one by G. R. Treviranus on the analogy between certain organized bodies found in animals, and the pollen of plants is particularly so. Besides the papers we have enumerated, there are several others well deserving attention, and much scientific information, some of which we shall communicate to our readers at a future time.

## MISCELLANIES.

*Comparison of the Light of the Sun with that of the Fixed Stars.*—In the "Philosophical Transactions" for the year 1767, a suggestion is thrown out by Mr. Mitchell, that a comparison between the light received from the sun and any of the fixed stars might furnish data for estimating their relative distances; but no such direct comparison had been attempted before the time of Dr. Wollaston, whose observations on the subject were communicated to the Royal Society in a paper read on the 11th of December. Dr. Wollaston was led to infer, from some observations which he made in the year 1799, that the direct light of the sun is about one million times more intense than that of the full moon, and therefore very many million times greater than that of all the fixed stars taken collectively. In order to compare the light of the sun with that of a star, he took as an intermediate object of comparison the light of a candle reflected from a small bulb, about a quarter of an inch in diameter, filled with quicksilver, and seen by one eye through a lens of two inches focus, at the same time that the star or the sun's image, placed at a proper distance, was viewed by the other eye through a telescope. The mean of various trials seemed to show that the light of Sirius is equal to that of the sun seen in a glass bulb, one-tenth of an inch in diameter, at the distance of 210 feet; or that they are in the proportion of one to ten thousand millions: but as nearly one-half of the light is lost by reflection, the real proportion between the light from Sirius and the Sun is not greater than that of one to twenty thousand millions. If the annual parallax of Sirius be half a second, corresponding to a distance of 525,481 times that of the sun from the earth, its diameter would be 3·7 times that of the sun, and its light 13·8 times as great. The distance at which the sun would then require to be viewed, so that its brightness might be only equal to that of Sirius, would be 141·421 its present distance; and, if still in the ecliptic, its annual parallax in longitude would be nearly three seconds; but if situated at the same angular distance from the ecliptic as Sirius is, it would have an annual parallax in latitude of 1·8 seconds.

*Temperature of Greenland.*—During the eleven years M. Müller has resided in Greenland, he has only twice heard the sound of thunder, which, repeated by the echoes of the mountains, produced, according to him, a most extraordinary and unusual noise. At Frederikshaab the temperature of the only spring which existed in the neighbourhood, and which is about half a mile east from the establishment, is 37° Fahr., whilst that of the atmosphere is 41°. This spring, which is on all sides surrounded with snow, forms a nearly circular basin, from nine to ten feet in circumference, and is about two feet deep. The temperature of the Greenland huts, during summer, varies from 47° to 54° Fahr., according to the number of inmates, and as the lamp is lit or otherwise. The temperature in the open

Digitized by Google

air was 43°. The height of one of the highest ice-mountains or islands seen by the Recherche, was found by calculation to be 167 feet: it probably had a double base.

*Red-coloured Sea.*—On the 12th of March (to the north of Cape Pilaris, in South America), precisely at noon, we were not a little alarmed by a considerable noise upon deck, and by the order immediately to lie-to. The dirty red colour of the sea had produced the very reasonable suspicion that we were upon a shoal. However, upon sounding, there was no bottom with 130 fathoms. From the topmast, the sea appeared, as far as the eye could reach, of a dark red colour, and this in a streak, the breadth of which was estimated at six English miles, and which here and there spread into short side branches. As we sailed slowly along, we found that the colour changed into a brilliant purple, so that even the foam, which is always seen at the stern of a ship under sail, was of a rose colour. The sight was very striking, because this purple stream was marked by a very distinct line from the blue waters of the sea; a circumstance which we the more easily observed, because our course lay directly through the midst of this streak, which extended from south-east to north-west. The water, taken up into a bucket, appeared indeed quite transparent.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, May 17, Dr. Birkbeck, on Osteology.—Friday, 19, Mr. Phillips, on National Melodies, at half-past eight.

*Aldersgate-street Institution*—Wednesday, May 17, Robt. Addams, esq., on Dynamics, at eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, May 18, Mr. Wyld, on the Construction and use of Railways.—*Conversazione* under the direction of Philosophical Class, at half-past eight.

*Eastern Athenæum.*—Wednesday, May 17, N. F. Laba, esq., on the Literature of Poland, at eight.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge road.—Tuesday, May 16, W. Lukeing, esq., on Heat, Dew, Rain and Hail, at half-past eight.

*Poplar Institution*, East India Road—Tuesday, May 16, John Hemming, esq., on Chemistry—Chlorine, at eight.

*Eastern Literary and Scientific Institution*, 88, Hackney-road.—Tuesday, May 16, T. King, esq., M. D. on the Digestive Organs, at eight.

*Mutual Instruction Society*, Great Tower-street.—Monday, May 15, Mr. Mackintosh, on the Electrical Theory, at eight.

*Kentish Town Mutual Instruction Society.*—Monday, May 15, Mr. Holdernesse, on the system of Sunday School Teaching, at half-past eight.

*Bermondsey Mutual Instruction Society.*—Monday, May 15, Mr. Logan, on Phrenology, at a quarter-past eight.

*Finsbury Mutual Instruction Society.*—Tuesday, 16, Mr. Dalton, on Animal Physiology, at half-past eight.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Printers' Ink.*—Sir, would you have the goodness to inform me through the medium of your useful periodical, how I can make Ink for Copper-Plate Printing, and you will oblige

Yours very Obediently,
A YOUNG PRINTER.

*Manufacture of Colours.*—Sir, I am induced to write to you to request to know if any of your Correspondents can inform me the best means to procure a Carmine and Lake, or Scarlet and Crimson. Having been a regular subscriber to your valuable work from its commencement, I remain,

Your obedient Servant,
JOHN YOUNG.

*Gold and Silver Inks.*—Can any of your Correspondents favour me with a receipt for making Gold and Silver Inks?

AN ORNAMENTAL PENMAN.

*Royal Academy Prizes*—Sir, Being informed that there are fifteen Medals given every three years at the Royal Academy, I should be glad to be informed of the particular departments of the arts, for proficiency in which, these medals are bestowed.

I am, Sir,
Your most obedient Servant,
G. D. B.

## To our Readers.

*Grateful for the patronage which has been already afforded the work, and anxious to promote a still larger Circulation, the Proprietor of the* PENNY MECHANIC *respectfully announces his intention of occasionally giving*

## TWELVE LARGE OCTAVO PAGES,

*Instead of the present Number,*

## Without any Extra Charge!!!

*This will afford both Editors and Correspondents much additional space, and will enable them to present the Public with* A LIST OF ALL THE NEW PATENTS, *at One-third the Expense of any other Publication! To Advertisers it will also afford a desirable facility for making known their Inventions. And the Proprietor cannot but express his hope, that the increased Sale of the Work will justify this as a* PERPETUAL *instead of an* OCCASIONAL *Enlargement.*

## TO CORRESPONDENTS.

*If* M. K. *can inform us for what particular kind of machinery, or process, the patent was granted, perhaps we can assist him.*

D. *Six shillings per Quarter, and two shillings and sixpence entrance fee.*

X. X. *The combustion of the mixed gasses Oxygen and Hydrogen, upon lime produces the most intense light that can be procured. The light produced by Galvinism upon Mercury is not more powerful.*

A Young Mechanic's *communication shall be attended to.*

*All Letters for the Editor should be post paid.*

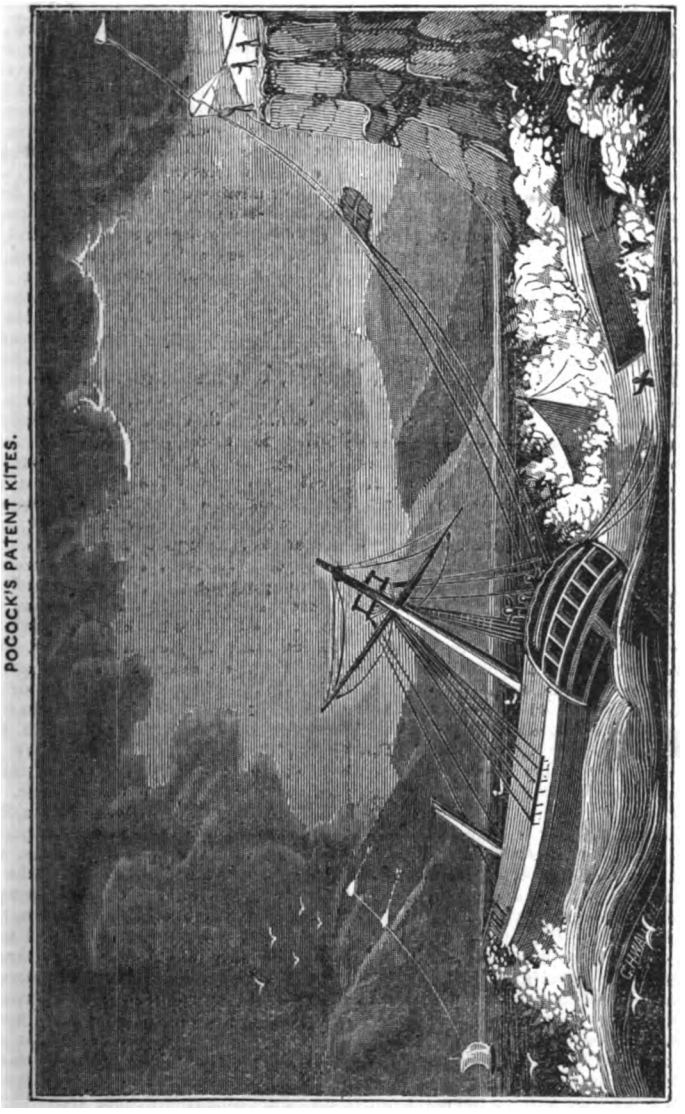
London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC.

## A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXX.] SATURDAY, MAY 20, 1837. Vol. I.



POCOCK'S PATENT KITES.



Holloway Press: D. A. Davidge.

Digitized by Google

## POCOCK'S PATENT KITES.

We this week present our readers with an engraving of this singularly-interesting invention, as applied in cases of shipwreck; by which in the last extremity, when all hope of saving the ship is at an end, the distressed mariners may be safely landed, one by one, upon the cliff or the shore. At first sight the case may appear altogether improbable, that there should be sufficient power in the kite to sustain the weight of a man upon the cords to which it is attached; but the inventor himself has dispatched one of the members of his family to a considerable height, and then replaced him upon the ground with the most perfect ease and security. When therefore a strong wind, such as would drive a ship ashore, is taken into the account, the question must be placed beyond a doubt.

We have adverted to the merits of the invention in an early number, and are again induced to do so, in consequence of a rapid journey which the son of the inventor performed from Bristol to London, a few days ago; since which we have had an opportunity of witnessing for ourselves the successful application of the kites to the purposes required. Three gentlemen took their places in the charvolante, on the morning to which we allude, and, though the wind was very moderate, they were drawn with tolerable swiftness. The command which the conductor has over the kites is perfectly astonishing, inasmuch as by the simple pulling of a line, the kite can be thrown right or left, higher or lower, in any direction the wind may require, thus enabling the traveller to avoid any obstacle in the shape of trees, church steeples, &c., which in the course of travelling, might otherwise impede his progress.

We have before us a work of Mr. Pocock's, containing many interesting particulars connected with the kite, from which we propose to make a few extracts for the gratification of our readers. Alluding to his first exploits, the author says, "On one occasion the kite's-string was attached to the end of a board, about six feet long and fifteen inches wide: on this quickly-made sledge one of my sons seated himself. On letting go the string, the sledge was instantly hurried away so unexpectedly, and with a velocity so great, that all attempts to overtake it were quite fruitless. Mezeppa's wild horse was as easy of control. The young solitary *Laplander* courageously kept his seat, the kites dragging him and his novel vehicle over hillocks, and ruts, and beds of furze, till he arrived at the opposite extremity of the Downs, where descending into a quarry on his well-poised sledge, he alighted at the bottom (as it happened) in perfect safety, and when his panting pursuers, who had 'toiled after him in vain,' arrived at the goal, they found the fortunate adventurer still seated on his car, exulting that he had kept possession of his runaway equipage, and that he had so distanced his comrades in the race. By this first perilous journey it was learnt, that no horse or rein-deer in car or sledge could successfully compete with kites in speed, and also that no mode of travelling would be so dangerous and precarious, unless the kites could be controlled and the vehicle directed and stopped."

After mentioning an alteration he has made in the construction of the kites, so as to have more perfect control over them, he says, "The first trial of these sails was on Charleton Pond, an extensive sheet of water belonging to the Earl of Suffolk, the use of that nobleman's pleasure-boat being kindly granted for the purpose; when it was proved beyond doubt, that the kites might be applied with certain success, but it was discovered also that their aquatic application called for many improvements. As, in making the first trial by land, an unexpected occurrence took place, so also did something of a similar nature happen on this occasion. While scudding along, under our buoyant sails, an oar had dropped overboard, and having no means of stopping the boat, we traversed to the nearest shore; there the kites were given in charge to three country boys, while we rowed back to pick up the oar. When returning, we heard a great cry out from the lads on shore: they had been dragged by the kites close to the water, into which, but for the interposition of some young trees, they must inevitably have been drawn, unless self-preservation induced the relinquishment of their charge. The cause of the disaster was this: a fourth boy coming up, and naturally, perhaps, wishing to have a hand in the work, pulled upon the brace-up line, the very one we had given the others peremptory orders not to touch. By this act, the draught-kite was brought into full action, and the more the boys pulled, the more did the kites. However, the juveniles were speedily relieved and informed of the cause of the error; for the moment the lad relinquished his hold of the brace-line, the overwhelming power ceased."

"The power of a kite twelve feet high," says the Editor, "with a wind blowing at the rate of twenty miles in an hour, is as much as a man of moderate strength

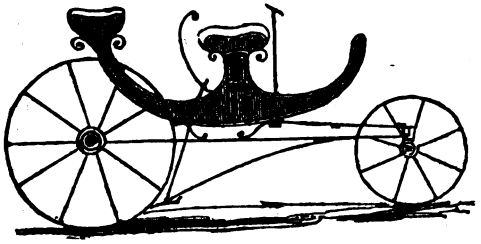
Digitized by Google

can stand against. With a rather boisterous wind, such a kite has been known to break a line capable of suspending a weight of 200lbs. This kite spreads a surface of forty-nine square feet. It should be particularly noticed, that these may serve as standing ratios, from which, by the rule of proportion, the power of larges kites can be calculated. But let none mistake, by supposing that a kite of thirty-six feet in length has only three times the power in length, and three times the power in breadth, which will make the multiple nine; so that it would lift or draw nine times as much as a kite of twelve feet. Two kites, one fifteen feet in length and the other twelve, have sufficient power to draw a carriage with four or five persons, when the wind is brisk."

In cases of shipwreck the Patentee's portable kites, are unfurled and ready instantly: by them may be suspended very considerable weights; they may be lowered or raised at pleasure, till hold is taken by the grapnel. Other kites would fly only in the direct course of the wind: these may be veered, and dropped to the right or left of the wind's course, to a very considerable angle: and thus, if the anchor does not hold in one spot, it may be elevated, and let down in another, till a proper catch is obtained. But should it be deemed more expedient at once to send a person on shore, with a rope, to make every thing secure, he may be borne above the bustling billows, and alight like a bird, a messenger of good from the flood, on the cliff or beach, according to the relative situation of the wreck. Again, it might so chance, that even a rope would not render all that aid which circumstances required, for should it so unfortunately occur, that female passengers and children were among the despairing number of the shipwrecked, what mode so desirable as to swing them securely in a hammock or cot, and thus transport them, as in an ark of safety, above the foaming billows; and land them over the spray, dry-shod upon the shore?

In the same way, might every one be landed, even the last, if circumstances require. In cases of shipwreck, at a very considerable distance from the land, a patent kite, of the smallest size, would safely tow several men to shore, on the surface of the waves. Again, in despairing cases of ships foundering at sea, of what varied service might these inventions be! One single kite would draw, and aid to buoy up, a considerable spar, or little raft, keeping it from rolling or turning over; serving, at the same time, for a sail, and signal of distress, so lofty and conspicuous, as to attract very distant observation. Again, were the string of a kite fastened judiciously beneath a person's arms, it might support him for hours, and waft him within reach of help, or to some shore, or into some haven;—

"Where aid may soothe away the pangs of fear,
Or pitying stranger drop compassion's tear."



DESCRIPTION OF THE CHARVOLANT.

This vehicle, constructed expressly to be drawn by kites, has the following peculiarities.

1st. Before the charioteer, is an upright spindle, with a T handle at the top; the lower end of this spindle, which runs through the bed of the car, is square, fitting into the socket of a small solid horizontal wheel, fastened to the pivot of the front axle-tree: by this apparatus, termed the guide, the chariot is directed with the nicest precision.

2ndly. There is a regulator, or drag, suspended by a spring, beneath the hinder part of the car; the shoe of this drag is pressed by a lever power on the ground, by which too great a velocity is prevented, or the vehicle suddenly stopped: this is effected without alighting. There are several minor appendages not common to other carriages; as a reel, and places for the chronometer, mariners' compass, &c. This car having moveable shafts may be used with horses, precisely the same as other carriages.

Digitized by Google

We conclude this article by giving one or two anecdotes of eye-witnesses. It is by no means wonderful that persons should refuse credence to their friends, when they doubt the certitude of their own vision; as in the case of a gentleman, who one day meeting the flying expedition, very politely begged the conductors to pull up for one minute: he then intreated permission to examine the wheels, and when he found there was no concealed machinery, "Well," said he, "I suppose I must now believe that your car is actually drawn by kites, though I have often denied the possibility of such a thing; however, as I value my character, be assured I shall never venture to relate what I have seen, being persuaded that should I do so, I should weaken the confidence of my best friends, and poison their good opinion of me for ever. In this case, it appears, the objection was this: It was not conceived possible for the kites to possess power adequate for the drawing a carriage; but had the above gentleman been present on one occasion, an old woman would have read to him the secret at once. He looked no higher for the discovery than to the grovelling wheels; she possessed far more elevated penetration. Addressing a number of her neighbours who were surrounding her as their oracle, she observed, "I'll tell you all about it!" Then, with a deal of *sang froid*, taking a pinch of snuff, she added, "they have got a man up there behind the kite, and he is pulling them along."

D. D.

## REWARDS FOR INVENTIONS.

Governments profess to grant patents, with a view of benefiting the public, by encouraging individuals to exercise their talents for discovery. This profession is false, and not borne out by the facts; otherwise the enormous fees, of from one hundred to three hundred pounds, would not be demanded for each patent-right. The truth is, that governments do not care about patents at all, except so far as they are a commodity whereby revenue may be raised, either for the government or its creatures. Were this not the fact, the expenses of patents ought only to amount to the bare cost of registering them. As regards the public, it is probably more injured by the monopoly of the patent-right than it would be, were the inventors left to take their chance. It is a mistake to suppose that the higher class of invention is promoted to any great extent by the hope of pecuniary reward. Mechanical invention—generally speaking—like music, poetry, philosophy, painting, or acting, is the result of a peculiar temperament of mind, formed by circumstances which the individual is frequently not aware of; but a number of which circumstances have constituted what is called his character. The mechanical inventor is driven forward in his career by an impulse which he cannot resist. If a man is born wealthy, and beyond the necessity of exertion, it is probable that his dormant genius will never be elicited; but a man whose imagination is once devoted to the path of mechanical discovery, can never afterwards abandon it, whether he become rich or remain poor; new discoveries become the unalterable tendency of his faculties, and he will at all times be ready to sacrifice a present certainty for a future contingency. The accumulation of money ceases to be an object with him, when compared with the higher objects he has in view, and which he doubts not will at all times place him beyond the reach of want. He lives in the clouds, and, like the seekers after the philosopher's stone, in the olden time, he makes many useful discoveries, while prosecuting objects which he can never attain. As the "elixir of life" and the "philosopher's stone" have been one cause of the advance of chemical science, so has the "perpetual motion" caused mechanical invention to improve. But in the mean time, the hunters after all three have generally dwelt upon the verge of want. In the present day, to call a man a schemer, *i. e.* an inventor, is equivalent to calling him a needy man. Even in the case of really valuable inventions, useful to the whole community, how rarely do the inventors permanently benefit by them! The speculator, the dealer, is constantly on the watch, to appropriate them, and realize a large fortune, while the inventor is usually left to starve, till he has struck out some fresh plan, whereby to procure another small supply of means. How then can the patent-right be said to encourage invention? Thus it is with the inventive writers of books. With years of labour, and study, they accomplish new discoveries in the regions of thought. The copyright is secured to them, but what avails it? The booksellers see a chance of profit, and the market is deluged with compilations; using the same matter and ideas, couched in varied language. The author angrily complains, but he might as well talk to the winds. The fact is, that the patent-right of the inventor, and the copy-right of the author, are injudicious modes of remunerating public services, and do not accomplish

Digitized by Google

the desired object. In a more healthy state of the public mind, better means will be resorted to. At present they are a necessary evil.

In England, a man can take out an exclusive monopoly, or patent-right for any invention, not up to that period used in England; even though in another country it may have been in use ever since the days of Noah. The legislators of the United States see the injustice of this, and refuse to grant patents for any invention not entirely original; on the principle, that to give any individual the monopoly of a useful branch of knowledge, to the exclusion of the public, merely because that individual happened to be the first who gained a knowledge of it in a foreign country, without any exertion of industry or application on his own part, would be an injustice to his fellow-citizens, who might otherwise all have an equal chance of benefiting by it. For an entirely original invention they grant a patent-right; and charge, as fees, a few dollars, to cover the expenses of the office.

The principle put forth for the granting of patents is—public benefit. Supposing the discovery to be really valuable, it will be found, that the use of it remains very limited till the monopoly expires; for this reason—the holder can obtain as much advantage from a small return, with a large per-centage, as he can from a large return, with a small per-centage. The former causes him much less trouble; and therefore, he will prefer it, just as the East India monopolists preferred the importation of a small quantity of tea to sell at a large price, to the importation of a large quantity to sell at a small price. In either case of monopoly, the public must suffer.

But there is a great injustice in patent-rights at the very outset, independently of their mischievous tendency. They are barefaced attempts to monopolize the principles of nature, just as the whole raw material of the world has been monopolized. To invent, is—to find out, not to manufacture. A manufacturer is clearly entitled to the benefit of his labour. An inventor merely discovers the existence of certain principles—he cannot manufacture new ones. All principles exist in nature. Because a man happens to be the first discoverer of a new principle, he cannot debar other people from the uses of it, as if he were the manufacturer of it. There must have been an original inventor or finder-out of the principle fire; but that did not make it his exclusive property. Had it been otherwise, fire might up to this period have been a luxury confined to an aristocratic few.

Amongst savage tribes, if an individual discovers a new and more successful mode of hunting or fishing, he either makes it known to his tribe, or keeps it a secret as long as he can, if he be of a selfish nature. If game and fish are scarce, he will most likely keep it to himself; if there is a surplus, pride will probably induce him to make his skill known. But he never dreams of monopolizing his invention, unless he should perchance be the only individual capable of fabricating it. Were he to attempt to prevent others from fabricating it, he would be either laughed at, or slain, to settle the dispute. Patent-rights, then, are an invention of civilization, and like other monopolies, were perhaps very useful, to encourage genius in the infancy of states, though even that is questionable; for borough towns, the early seats of the arts, have certainly in latter days been as mischievous in retarding improvements, as they were originally advantageous in protecting the rise of improvements. It may be asked, if it would be proper or just, to leave inventors, who are incapable of protecting themselves, to starve? Certainly not. But would it not be practicable to protect the inventor in a much better way, and in one more beneficial to the public at the same time? It has been shown, that the profiters by inventions are not usually the inventors themselves, but mercantile speculators. Would it not, then, be better to make the pecuniary reward hereafter an inalienable annual pension, paid by the public, the amount of which might be regulated by the importance of the invention; the number of people by whom it was used, and the national saving or advantage accruing therefrom? The pension should also terminate with the life of the inventor. Such a method would clearly be to the advantage of the whole body of inventors, for they would thus be saved from the miseries of want which many of them undergo. Should any inventors object to such a mode of remuneration, and, vain of their own abilities, think that they ought still to be allowed to dictate to the public, by means of a monopoly, it would be well to remind them, that there is no obligation on them to make known, any more than there is on the public to use, their inventions. It is a matter of mutual bargain. The skill of the workman who executes is as needful for the perfection of the invention as is the genius of the discoverer who devises it; and neither of them would be one whit benefited, were it not for the public, who purchase and use it. Let not the inventor, then, arrogate too much

Digitized by Google

to himself, because those happen to be few who pursue his vocation; but let him remember the fable of the belly and the members! Many varieties of talent are requisite to accomplish the perfection of a machine.

[There is much truth in these observations of "Junius Redivivus," but we very much doubt whether the plan he suggests would act well. We think it is far better to leave the reward for inventions in the hands of the public, than to intrust it to *any* government. In the latter case, all kinds of abuses would occur, some patentees would be favoured—some neglected; we see no means of preventing this; but as it is now, although some inventors do not certainly receive so great a reward as they should, the majority are not neglected if their invention is really useful. The public judge of a patent by the very best test that can be applied to it—its utility. As the usefulness of some inventions, however, are not appreciated sufficiently at first, we certainly think that in such cases government ought to reward the patentee.—ED. P. M.]

## FACTORY WOMEN.

THE factory system is much condemned by some persons, and very strongly supported by others. Like every thing else it has advantages as well as disadvantages attending it, but some of the latter are of a nature that certainly call at once for their immediate removal. Of these we might particularly notice the employment for children, and the great length of time they are obliged to continue at work; but another evil, and one that probably in a great measure produces the first, is the employment of women in the factories. The pernicious consequences of allowing the wives of artizans to give up their domestic duties, for the duties of the workshop, is not seen merely in the destitute and too often depraved condition of their families, or even in their own loss of character, but it is seen more powerfully in its influence on the character of the husband: it is in consequence of his having no home, or none of the comforts that he ought to find at home, that he is induced to waste his money, time, and health, in the public house, when he ought to devote all to the service of his family. The evil consequences of the system were ably pointed out, some years since, by Mr. Gaskill, in a work on our manufacturing population, and his remarks are equally, if not more applicable now, than they were when the book was first published. He truly remarks that the moral influence of woman upon man's character and domestic happiness, is mainly attributable to her natural and instinctive habits. Her love, her tenderness, her affectionate solicitude for his comfort and enjoyment, her devotedness, her unwearying care, her maternal fondness, her conjugal attractions, exercise a most ennobling impression upon his nature, and do more towards making him a good husband, a good father, and a useful citizen, than all the dogmas of political economy. But the factory woman cannot have this beneficial agency upon man's character. Her instincts, from their earliest birth, have been thwarted and pushed aside from their proper channels; they have had no field in which they could be cultivated, no home where their abberations might have been checked, no legitimate object on which her love could be lavished; on the reverse,—her passions have been prematurely developed, her physical organization stimulated into precocious activity, her social affections utterly blighted, her person rendered uninviting by its want of feminine gracefulness; her occupation has destroyed her home sympathies and maternal affections, and finally, in place of seeking her pleasures, enjoyments, and happiness in ministering to the wants and welfare of her household, she seeks her gratification in other, less pure and less womanly stimuli, fatal alike to her health, comfort, and appearance.

Under these circumstances, woman is reduced to precisely the same grade in the social rank which she holds in half civilized countries. She is no longer the companion of man, in the proper meaning of the term; but is a mere instrument of labour, and a creature for satisfying his grosser appetites. It is true, her condition differs in some respects from that of her sex in countries which are called savage; she is not the slave, though she is no longer the companion of man; neither is she the subordinate being whose interests are esteemed so secondary as to be totally unregarded;—but, as far as concerns the better portion of her attributes, she is upon the same degraded level.

Nothing would tend more to elevate the moral condition of the manufacturing population, than the restoration of woman to her proper social rank; nothing would exercise greater influence upon the form and growth of her offspring, than her devotion to those womanly occupations which would render her a denizen of home. No great step can be made till she is snatched from unremitting toil, and made what Nature meant she should be

Digitized by Google

—the centre of a system of social delights. Domestic avocations are those which are her peculiar lot. The poor man who suffers his wife to work, separated from him and from home, is a bad calculator. It destroys domestic economy, without which no earnings are sufficient to render him comfortable; it produces separate interests, and separate sets of feeling—they lose their mutural dependance upon each other—their offspring is suffered to starve or perish—to become, even as a child, the imitator of their bad example—to have its frame permanently injured—to acquire bodily conditions which it must, in its turn, transmit to its own children—for, by their being thus early implanted, they become part and parcel of its very nature—till, in the end, a point of physical declension will be reached, from which the return to a condition approximating to that of the more perfect and valuable part of the species, must be by slow and painful gradations.

## ARITHMETICAL PUZZLE.

*To the Editor of the* PENNY MECHANIC.

SIR,—Although the following little puzzle is not exactly of a *scientific* nature, (partaking more of the *mathematical*), still I have no doubt that to the Juvenile part of your readers, it may serve as an amusing arithmetical puzzle, which if it does not add to their instruction, it certainly will to their amusement; and thus you have it.

Desire a person to set down any figures he may think proper, and multiply them by 9, and their product by any other figure he chooses; that being done, tell him to strike out one figure from the product (any one he likes) and tell you the remaining ones, which you must add together, and see how many times nine will go in them, and add as many figures to the remainder as will make up nine, and those figures will be the one erased; for instance suppose he set down

```
                3246
                   9
              -------
1
7             29214
5                  6  (or any other fig.)
2             -------
4             175284  (strike out 8.)
-----
9)19
-----
   2  1 wants 8. The fig. erased, to
         make 9.
```

Of course when there is no remainder, 9 is the figure struck out. After having once multiplied by 9, the product may be multiplied as after, and by what figures you like.

I remain,
Sir, with due respect,
Yours, &c.
SNUBBY GONG.

P. S. I take this opportunity of expressing to you my thanks; (which are due, not only from me, but from all your readers), for the small and clear type with which you have accommodated us, thereby embracing "*multum in parvo*," and likewise to request the favour of your informing me, how many Magazines, are intended to complete one volume, 28 being already out. I thought 26 (completing the half-year) would have formed one.

[WE at first intended publishing a *Volume* every half year, but thinking the volume would be too thin, we propose binding the Numbers together once a year, like most of the other cheap periodicals.—ED. P. M.]

# INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, May 24, Dr. Birkbeck, on Osteology.——Friday, 26, Mr. Phillips, on National Melodies, at half-past eight.

*Aldersgate-street Institution*—Wednesday, May 24, C. Johnson, esq., on Botany, at eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, May 25, Mr. Everitt, a popular review of the recent discoveries of Professor Faraday in Electrio Chemistry, at eight.

*Eastern Athenæum*.—Wednesday, May 24, E. Slatterie, esq., on Elocution, at eight.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge Road.—Tuesday, May 23, W. C. Denby, esq., on the Structure and Physiology of the Ear; and Sound, at half-past eight.

*Poplar Institution*, East India Road.—Tuesday, May 23, Col. Thompson, M. P., on Free Trade, including the Corn Laws, at eight.

*Eastern Literary and Scientific Institution*, 88, Hackney-road,—Tuesday, May 23, M. Wylie, esq., on the Poetry of Wordsworth, at eight.

*Mutual Instruction Society*, Great Tower-street.—Monday, May 22, Mr. Corcoran, on Hydrostatics and Hydraulics, at eight.

*Kentish Town Mutual Instruction Society*.—Monday, May 22, M. Collis, on the Atmosphere, at eight.

*Bermondsey Mutual Instruction Society*.—Monday, May 22, Mr. Logan, on Phrenology, at a quarter-past eight.

*Mechanics' Institution*, New Road, near Gower Street.—Tuesday, May 23, Mr. Bolton, on the Principles of Political Economy, at eight.

*Finsbury Mutual Instruction Society*.—Tuesday, 23, Mr. Dalton, on Animal Physiology, at half-past eight.

Digitized by Google

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Yesterday afternoon Holloway and its vicinity were visited by a most appalling thunderstorm. The day had been perfectly serene, with a tolerably clear atmosphere, till about one o'clock, when clouds began to accumulate, and about three a most tremendous explosion following one of the most vivid flashes of lightning ever seen broke suddenly upon the neighbourhood. It was truly astounding, and terror seemed depicted for the moment upon every countenance. Self-possession being restored, the inquiry became general, "Where is the mischief?" Providentially it has not extended far. Some newly-built, but unfinished houses, at the end of the Liverpool Road, are considerably injured, and a gentleman who had taken shelter under them was in imminent danger from the bricks falling from the chimney and parapet above him; however, he managed to protect himself with his umbrella, and suddenly fled from his perilous situation uninjured.

When thunder-clouds float low in the atmosphere, as was the case yesterday, there is evidently much danger to be apprehended, and the attention of scientific men would be well directed to the subject. Dr. Franklin's metallic rods would at all times, no doubt, be successful in drawing off the electric fluid from an impending cloud, and averting the danger; but the expense of erecting them, several being necessary to secure a building of any size, is an objection to their general adoption. Would not a single metallic rod to which an electrical kite may be attached answer the purpose? The kite floating over a building or a range of buildings, would, one might imagine, thus carry the electrical fluid silently to the earth. Probably some of your readers, better acquainted with the subject than myself, would be kind enough to reply to this inquiry, and to state what they know from experience relative to the application and success of metallic rods.

I am, Sir.
Your Friend, and Servant in your
*Holloway*, Interesting Publication,
*15th May*, 1837. N. O'MEL.

*Quill Making.*—Sir, I beg to inform Mr. Clements that the object of my inquiry is, to know the *entire* process Quills must undergo in the manufacture or preparation; and how the different colours are given them.

I am, Sir,
Your obedient Servant, C. D.

*Living Model.*—Can any of your correspondents inform me of any place, besides the Royal Academy, where a person can study the living human figure. And I should also feel obliged by being informed of what *modelling clay* is composed.

R. S.

*Works on Botany.*—Sir, I should take it as a favour if you or one of your numerous readers, will inform me of the best publication to instruct a Cottager in the art of mixing earths, or compositions for growing different flowers in a conservatory.

Your very obedient Servant,
J. D.

[Professor Rennie some time since published a very useful little work that may perhaps assist our correspondent; it is called "the Hand Book of Gardening."]

*Fireworks.*—Sir, It would oblige me greatly if you or any of your correspondents could inform me how to make the various coloured fires, similar to those which are bought at the fire-work makers. I know the principal ingredients, but not in what proportions they are used. An early insertion of the above would oblige one of

Your sincere well-wishers,
A. B. Y. Z.

### ANSWER TO QUERY

*Tracing Paper.*—Sir, Having observed a query in Number 26 of your valuable Periodical, "which is the best method of preparing Tracing Paper, &c." I take the liberty of answering it.

Take two ounces of Canada balsum, and dissolve them in about four ounces of spirit of turpentine in a bason; then take a quire of silver (not tissue) paper; spread it out smooth, and with a brush (which the painter calls a ground tool) pass over every part of the upper sheet of paper with the varnish, and with the same brush (made as dry as it can be, scraped against the side of the bason), rub the varnish well into the paper, then turn the sheet over the other side also. Enough of the varnish will have pierced through from the upper side also, and indeed the second and third sheets, which is the reason why I spread out the quire of paper at once, by that means a great part of the varnish will be saved; when the sheet is done on both sides, hang it on a pack-thread line to dry, (which will be in about twelve hours) and proceed with the rest in the same manner. R. S.

*Alarums for Clocks.*—Sir, I shall feel much obliged if some of your correspondents can inform me how I can make a cheap alarum for a common Dutch Clock, or where I can purchase one. I wish to have one that can be detached from the clock, if required; and the more simple its construction the better. If any of your correspondents would like to manufacture a few alarums agreeing with the above particulars, I think I could dispose of some, provided they were not very expensive; at any rate I would purchase one myself in order to encourage the inventive genius who should make it. I hope soon to see an answer to this in your columns; and have no doubt but that if individuals who are in want of any little piece of machinery, were to make a similar application to the present, and offer some inducement for exertion, they would soon have their desires gratified.

Yours obediently,
D. N.

## TO CORRESPONDENTS.

Z. Wigo. *The London Mechanics' Institution. Merely apply to the Secretary or Librarian.*

*Will* Mr. Clements *favour us with a longer paper on the subject. If he cannot do so conveniently, the one sent shall be inserted.*

M. *should have sent to us by Monday.*

F. *If the postage was not paid the letter was not taken in.*

L. D. L. *We intend shortly to give an account of the different Mechanics' Institutions in the Metropolis.*

*Two or three Queries that have been addressed to us personally, shall be answered the first opportunity.*

*We have more than once stated that we should be happy to insert the communications of Working Men, if the subject written on was likely either to benefit any particular class of workmen, or interest our readers generally. We need not say that we shall still be happy to open our columns for such communications; and if a few practical men would send us the result of their experience, we are sure, without injuring them, it would greatly benefit their less-experienced fellow workmen.*

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXXI.] SATURDAY, MAY 27, 1837. Vol. I.

## GREGORY'S ROTARY PUMP.

Fig. 1.

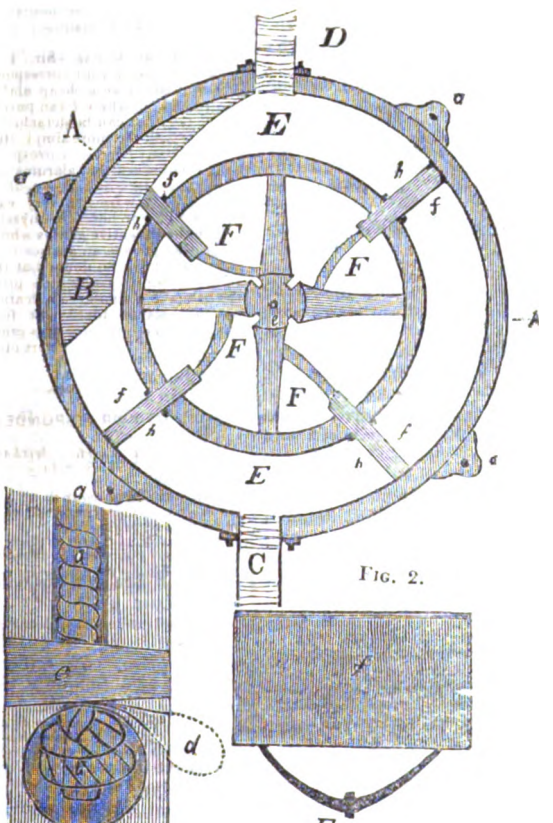



Fig. 2.

## MORTON'S WINDOW SASHES.

Fig 3.



Holloway Press, D. A. Doudney.

Digitized by Google

## GREGORY'S ROTARY PUMP.

THE following description of a Rotary Pump will perhaps be interesting to the readers of the PENNY MECHANIC. A A is the cylinder three feet in length, and one foot and a half in diameter, *a a a a* flanches to fix on the cylinder top, B a circular inclined plane by which the float-boards are forced in the revolving wheel E E, fixed on the axis, which works through stuffiing-boxes in the cylinder tops, and is turned either by manual or steam power, *f, f, f, f*. The float-boards acting through the stuffing-boxes *h, h, h, h*, and forced out by the springs F, F, F, F, the action of which will be seen better in fig. 2. C is the suction pipe, and D the eduction pipe, *g* fig 2. is the rivet to fix the spring F.

The action in my opinion is free from a great deal of friction which exists in most rotary pumps upon the axis being turned the wheel E E revolves, and the float-boards are forced out, so that a partial vacuum is formed; the water then rushes up the suction pipe, and is forced out of the pipe D into the air vessel, when the float-boards get to the part B they are shut, which prevents the pump choking. If for a fire-engine, I should propose the engine itself being forced off the ground, and the axis of the engine cranked, so as to convert the wheels into fly-wheels by fixing a handle to one of the spokes, and this would be done by a very simple arrangement, too simple to describe. Two cylinders, one for the back wheels, and one for the front, I think two men at each wheel, eight in all, would throw as great a body of water as twelve men in the reciprocrating engine; this is my opinion, and as a practical man I think I may venture to say I am not far out; perhaps some of your readers will favour me with their opinion on the subject.

J. G.

## MORTON'S WINDOW SASHES.

*To the Editor of the* PENNY MECHANIC.

SIR,—On reading an article in Number 21 of the PENNY MECHANIC, upon the danger attending the present mode of Cleaning Windows, with a new plan for hanging sashes, by W. Clements; by which the lines may be readily detached, and the evil remedied.; I herewith send you a simple plan which I have adopted and found to answer exceedingly well.

Yours respectfully,

A. MORTON.

DESCRIPTION OF ENGRAVING.

Fig. 3, shows the edge of a stile to an one-and-a-half-inch sash. *a*, the plow-grove with the sash-line *b*, a hole bored with a centre-bit to admit the knot of the sash-line. *c*, a piece of wainscot or other hard wood, dovetailed through the sill and which being smaller at one end may be removed at pleasure by a pressure with the finger. I tie a small piece of cord to the sash-line, making a loop, *d*, which when the line is detached, I pass over the shutter knob, or a small brass hook screwed into the inside lining of the sash frame, thereby preventing the line from running up.

## TEMPERATURE OF THE EARTH.

*To the Editor of the Penny Mechanic.*

SIR,—The peculiar answer which you thought proper to give to my question respecting the "temperature of the Earth below the surface," induces me to believe that you do not perfectly understand my meaning, in consequence of which I beg to explain it more fully.

I am, Sir, a working man, and the nature of my occupation requires that I should be better informed on the above subject, to enable me to accelerate certain improvements in my business; but unfortunately my means are limited to a very few scientific works, which are insufficient for my present purpose, namely, to ascertain at one view, or calculation, by a well-founded rule, the temperature of the interior of the earth at various depths, and to what depth, in the various latitudes an uniform temperature exists. The following is all I have been able to glean on the subject, and which is confined to about latitude 52°., from "the Gallery of Nature and Art," by John Hunter, M.D. F.R.S. "The great difference between the temperature of the open air, and that of deep caverns or mines, has long been taken notice of, both as matter of curiosity and surprise. After thermometers were brought to a tolerable degree of perfection, and meteorological registers were kept with accuracy, it became a problem to determine what was the cause of this difference between the heat of the air, and the heat of the earth; for it was soon found that the temperature of mines and caverns did not depend on any thing peculiar to them, but that a certain depth under ground, whether in a cave, or mine, or a well, was sufficient to produce a very sensible difference in the heat. In observations of this kind, there was, perhaps, nothing more striking than that the heat in such caves was nearly the same in

Digitized by Google

summer and winter, and this even in changeable climates, that admitted of great variation between the extremes of heat in summer, and cold in winter."

Extracted from the Philosophical and Mathematical Dictionary, by Charles Hutton, L. L. D.—"It is found by observation that the same degree of heat occurs in all subterraneous places at the same depth, varying a little at different depths, but is never less than 36° of Farenheit's thermometer. At 80 or 90 feet, and sometimes much less, the temperature varies very little, and generally approaches to the mean annual heat. The temperature of the cave at the Royal Observatory at Paris, of about 90 feet deep, is about 53½°, varying only about half a degree in very cold years. Mr. Boyle kept a thermometer, for a year in a cave 80 feet deep, and found the liquid remain stationary all the time. Dr. Withering made a similar experiment on a well 84 feet deep at Edgbaston near Birmingham, the temperature of which was found to be 49° in every month of the year 1798."

The opinion of Dr. James Johnson before a Committee of the House of Lords, on tunnelling for the Brighton Railway.

"Question. Do you think that a tunnel 600 yards in length, would produce any injurious consequences? Answer. A tunnel of 600 yards, if it is 80 feet under the surface, must of course have a temperature constantly of about 52 or 53°, consequently in summer, when the temperature of the atmosphere would be summer heat, or 76°, the vicissitudes would be upwards of 20° on emerging from the tunnel. On the contrary, if the temperature was at the freezing point, 32°, the rise of temperature on going into the tunnel would be 20°, and the exit would be on one of equal extent and magnitude.

"Question. In your opinion the temperature of the tunnel would be pretty nearly stationary? Answer. It would be always so, if it was 80 feet below the surface of the earth. You do not think it possible that a tunnel of 600 yards could be so ventilated as to bring it to an approximation to the temperature of the general atmosphere? I think it impossible to alter the temperature, because it must take the temperature of the parts surrounding it; the air might be changed, but whenever changed it would instantly come to the temperature of the solid parts around."

From these observations I have been led to suppose that there is, in a work unknown to me, some fixed criterion to be relied upon; if so, I should feel particularly obliged by your pointing it out, or giving me such information on the subject as you deem serviceable, hoping that I shall not be considered either impertinent or intrusive.

I remain, Sir,
Your most obedient Servant,
W. L. S.

[We are not ourselves acquainted with any work of the kind required by our correspondent, and we do not think that any scale has yet been constructed by which the temperature of the earth, according to its depth, can be ascertained. The geological theory of a great central fire, or other cause of heat near the centre of the earth, is now generally admitted to be true; and from several experiments lately performed by some French philosophers, at Paris, it appears probable that the temperature of the earth does increase in a certain ratio according to the distance from the surface; in what ratio, however, we are quite ignorant; and we do not think it has been definitely ascertained. There are other causes besides the heat of the earth that influence the temperature of the air in caves, tunnels, &c. The air is a very bad conductor of heat, and consequently, unless it is agitated, the influence of the sun on the external atmosphere will not be communicated to that within a cave. With respect to tunnels, we incline to think that Dr. James Johnson, when giving the evidence mentioned above, did not consider that there would be a frequent current of air in them, produced by the rapid passage of the trains; and that consequently the temperature of the air within a tunnel would not differ so materially as he thinks from that of the external atmosphere. In caves there are various causes operating to produce an uniform temperature, besides those just mentioned. The evaporation of moisture is prevented in a confined space, and one of the principal agents in cooling the surface of the earth, does not therefore operate in reducing the temperature of the confined air. The temperature of the *earth* will of course depend on other circumstances. Supposing some kinds of earth to be better conductors than others, of course the heat of particular parts will vary. As we before stated, however, we are not acquainted with any means by which our correspondent can determine this, except by actual experiment. As some of our readers may however be able to answer W. L. S. more definitely than we have done, we have inserted the letter for their consideration.—Ed. P. M.]

Digitized by Google

## THE HUMAN BODY.

### DIGESTION, ARTICLE II.

THE change that is effected in the food while in the mouth, depends very much upon the nature of the animal, and the kind of nutriment which it naturally prefers. Carnivorous animals (those which feed on flesh) do not retain the food so long in the mouth or masticate it so completely, as those that feed on vegetables; because in the former case the food is the same substance as that into which it is to be converted after undergoing the process of digestion; it consists of the same elementary principles as those which constitute the animals who feed upon it, and it therefore evidently does not require to undergo so great a change as vegetable food, which differs so materially from the flesh, bone, &c. into which it is to be formed. The teeth of carnivorous animals are accordingly fitted rather for the purpose of catching and destroying their prey, than for minutely dividing it; while the teeth of animals that feed on vegetable food, on the contrary, appear to be intended almost solely to prepare the food for the action of the chemical agents that digest it in the stomach. Man possesses teeth fitted for performing both these offices, and it is evident, therefore, that it was never intended he should confine himself to one kind of food alone. In some climates, and under certain circumstances, undoubtedly vegetable diet may be better calculated to preserve his health and intellect in a state of vigour than animal food; but it is equally certain that under other circumstances, a mixture of both, or a diet of animal food alone, will more effectually accomplish this object. Hence those persons are certainly wrong who imagine because the Hindoos and South Sea Islanders enjoy excellent health upon vegetable diet, that, therefore every person in this country ought to confine themselves to the same. Indeed, it might as well be urged, because the inhabitants of the Polar regions feed on flesh alone, and consider train oil and tallow candles delicious articles of diet, that Englishmen are naturally intended to subsist on such provision, and ought to do so. It has been found by experiment that a due mixture of animal and vegetable food is digested much quicker, and more effectually than a meal of either separately. This fact alone is quite sufficient to set the point at rest without reference to any other arguments, if indeed any is required in order to convince our readers that a plate of potatoes is all the better for having a nice mutton chop upon it.

Besides the mere subdivision of the food, another imporiant office is performed in the mouth: the food is mixed with the saliva. This may seem a very simple circumstance to many persons, but it is indeed very important; and it has been found, that food introduced into the stomach without having been properly mixed with saliva, is not digested near so rapidly as that which has been thoroughly incorporated with it. The saliva is formed by several glands situate about the mouth, and it has been calculated that they pour into it, during a good meal, not less than half a pint of liquid. The large quantity secreted, shows that it is intended to perform an important office in the animal economy; something more than merely lubricating the mouth and facilitating the passage of the food to the stomach; and it is found that persons who are in the habit of eating their food rapidly, do not enjoy such good health as those who masticate it sufficiently. We know in the case of the lower animals, that some will derive far more nutriment from a certain quantity of aliment than others; the cow, for instance, minutely divides its food, and incorporates it with the fluid of the mouth before passing it into the stomach, and by so doing, derives far more nourishment from it than the horse does from his food, a large portion of which is generally undigested. The gastric juice, the fluid that digests the food, will not act upon the husk of corn, or skin of fruit, and consequently, unless they are removed by mastication, so that the digestive fluid can attack the nutritive food contained within them, it is not digested at all. Paley in his work on Natural Theology, adduces as a proof of the goodness of the Deity, that he has not left the action of the vital organs, such as the heart, &c. under our control. Had such been the case, very many of us would forget or neglect to keep these organs in a proper state of activity. The truth of this observation is fully proved by the circumstance that the only function we are called upon to attend to in the process of digestion, namely, mastication, is in most cases quite neglected, compared with the attention it ought to receive.

After the food has been divided by the teeth, it is formed by the tongue into a small ball, and is passed to the back of the mouth, which from its resemblance to a funnel has been termed the pharynx; and from thence it passes down the œsophagus, into the stomach. Persons not much acquainted with the anatomy of the body, are apt to suppose that the entrance to the stomach and to the lungs is

Digitized by Google

by the same passage. This is a mistake. The trachea, or windpide, through which air passes to the lungs, is situated *in front* of the aesophagus, or gullet, which conveys the food to the stomach, and every morsel of food we eat is obliged to pass over the top of the windpipe before it can proceed to the stomach. A very beautiful contrivance exists for preventing food passing into the wrong channel. A little piece of cartilage, called the epiglottis, which covers over the top of the windpipe every time we swallow effectually prevents any of the food "going the wrong way" as it is termed, and even when this does take place, the air is expelled from the lungs with such force that the portion of food is immediately ejected. We very seldom hear of persons being suffocated while eating, although this would frequently take place were it not for the epiglottis. A description of this belongs more properly to the subject of "Animal Mechanics," than to Digestion, and we shall accordingly describe it more fully at a future time. In our next paper we shall describe the structure of the stomach, and the important change that is produced in it on the food by the agency of the gastric juice.

### PERPETUAL MOTION.

*To the Editor of the Penny Mechanic.*

Sir,—I have long perused your Mazagine with delight and satisfaction as to its value and good qualities, which I cannot say too much for. I now beg a small space in your columns to say a few words upon the long-sought-for Perpetual Motion, which may be compared to the Fox and Grapes, for if a man cannot come at his wishes he despises them; but that is not the way to come at them, but always to hold your point in view. Now my opinion respecting Perpetual Motion is, that it must some time or other come into operation, if it may be called perpetual motion, for perpetual motion means *to last for ever*, which I think cannot be got, for friction must overcome the motion presently. But if we call it Temperary Motion it would hit the mark much nearer. I do not see why a machine to continue in motion while it lasts, cannot be made, for if we look to the steam-engine, it was almost given up as useless, until the celebrated Watt brought it to such great perfection; but it will allow of much greater improvements yet. Some overwise persons pretend to say that perpetual motion cannot be come at. Why do they say so? Because they know a little, and think they cannot know more. But if they were to set their wits to work properly, instead of abusing other persons' thoughts, they would, I have no doubt, some time or other find it out. It is thus that a great number of useful things are lost, because persons are afraid of making their thoughts public for fear of being ridiculed, which causes great shyness. But they should brave it all.

I remain, Yours truly.

Z. Wigo.

## MANUFACTURES.

### MANUFACTURE OF IRON.

No. II.

Among the useful arts there are none certainly of equal importance in this country with the preparation of iron for the various purposes of utility to which it is applied. The following account of the early state of the art, by Mr. Donovan, will therefore, no doubt, prove interesting to our readers.

By what methods precisely our rude forefathers conducted their smelting processes so as to obtain malleable iron, we are not informed; though, as may presently be shown, the difficulties which they would have to overcome might be neither so many nor so formidable as some persons have imagined. But whether the Britons were indebted for their first knowledge of the art of subjecting iron, or merely for their improvement in that art to their invaders the Romans, it appears to be admitted that the latter established founderies for making iron, and erected manufactories of spears, battle-axes, and other implements, in almost every section of the kingdom conveniently adapted for such a trade. Nor need it be dissembled, that probably under those able instructors our ancestors acquired a proficiency in the working of iron, and thus laid a foundation for that celebrity which their posterity in after ages has so justly obtained.

The earliest operations of smelting in this, as in other countries, would, we may suppose, be extremely simple. According to the hypothesis before mentioned, the putting a quantity of ore upon a heap of wood, and setting the pile on fire, in conformity to the manner in which ores are presumed to have been melted during the burning of forests, was, it may be conjectured, the first rude process by which metals were extracted. But as the force of the fire is greatly diminished when the

Digitized by Google

flame is suffered to expand itself, and as the air acts more violently in exciting to a fierce heat when it rushes upon the fire with the greater velocity,—a phenomenon too obvious to be neglected even by barbarians,—it is likely that the heap of wood, or charcoal, would soon be surrounded with a wall of stone, in which sufficient openings would be left for the entrance of the air, and thus a kind of furnace would be constructed. The Peruvians, we are told, had discovered the art of smelting silver, either by the simple application of fire, or where the ore was more stubborn and impregnated with foreign substances, by placing it in small ovens, or furnaces, or high grounds, so artificially constructed, that the draught of air performed the functions of a pair of bellows; a machine with which they were unacquainted. The use of the bellows was certainly known in England at a very early period, though the precise era of their introduction is not ascertained. A rude contrivance, answering the purpose well enough, is constructed by the Hottentots themselves, who have long understood the methods of smelting both iron and copper,—a knowledge of which they might acquire from the Dutch settlers. Their furnaces are described as of a conical form, and built of clay, which becomes almost as hard as stone. A round opening is left at the top for receiving the ore, and underneath a space for the fire: the pile is open before and behind, not only for admitting the fuel, but the operation of the rude bellows, consisting of a skin bag distended and compressed by the hands.

The heaps of cinders found in various parts of this kingdom, especially in Yorkshire, indicate unequivocally the situations of ancient bloomaries. These are met with as well in the valleys as on the hills: the latter, however, have been supposed to belong to the earlier works, and to a period anterior to the knowledge of bellows. This has been partly inferred from the remarkable fact, that the cinders found on elevated spots almost invariably contain a large quantity of metal, the ore, on account of the inefficiency of the mere air draught, not having been thoroughly reduced. On the other hand, the slag found in low situations, where it is presumed the furnaces were worked after the introduction of bellows, is in most cases so completely exhausted, as not to be worth the trouble of re-smelting, even with modern machinery. In the sixteenth century the process, according to all accounts, was not many degrees advanced, with the exception of the bellows, and a better-constructed furnace, beyond the primitive practice.

After the departure of the Romans the arts began to ebb: at peace for so long a series of years, the inhabitants had almost forgotten what war meant; and, accustomed to the manufacturing of ploughshares and pruning-hooks, they might only remember, as things once heard of, the names of arms. Aroused from this state of torpidity by their northern neighbours, they suffered all the effects of a predatory war before they ventured on resistance; unarmed and dispirited, they appear to have sunk almost without a struggle. The frequency of insult at length aroused their native energy; but military prowess, much less military accoutrements, cannot be created in a day: hence those armies which formerly had made even Romans tremble, were no longer terrible to an inferior enemy. Their weapons were useless from want of exercise, and all their efforts only served to extend the ravages of their invaders, by making manifest the feebleness of the resistance opposed to them. Aided, however, by the Saxons, they drove the barbarous hordes of Picts again into the north, but submitted to those as masters whom they had invited as allies. Thus the ill-fated country, from a lamentable want of unanimity, had been successively enslaved by the Romans, the Picts, and the Saxons—it changed its tyrant, but not its servitude.

Mingling by slow degrees, the Saxons and the Britons in time formed but one people. The frequent quarrels of the princes of the heptarchy rendered the manufacture of arms again a work of necessity. The *Deiri*, supporting their prince by a liberal supply of weapons, and of soldiers hardy enough to use them, seated their Edwin on the throne of Northumbria, and supported him against the attacks of the infamous Penda; and he, in return, encouraged the arts of peace. For him the south Deirans are presumed to have tried a new fabric with their iron, for he had a number of iron dishes forged, which were fastened with chains beside the various springs and fountains which lay on the route generally travelled from one town to another, so that passengers might refresh themselves on their journey. According to local accounts, vestiges of these benevolent arrangements have not long since existed in that part of Deira which is comprehended within the wapentake of Stafforth and Tickhill.

The Norman conquest again laid waste the country in many districts, especially in the north, where William met with the

Digitized by Google

most determined resistance, and from whence it is probable the arms of the natives were principally derived. But, wherever may have been seated the principal forges of that period, it is certain that the army of Harold, was well supplied with swords and spears, and defensive armour; and, moreover, that a considerable degree of expertness had been acquired in the fabrication of articles from the anvil. One of our historians observes, that immediately preceding the Conquest "the art of working in iron and steel had arisen to such a state of improvement, that even the horses of some of the chief knights and barons were covered with steel and iron armour. Artificers, who wrought in iron, were so highly regarded in those warlike times, that every military officer had his smith, who constantly attended his person to keep his arms and armour in order. The chief smith was an officer of considerable dignity in the court of the Anglo-Saxon and Welsh kings, where he enjoyed many privileges, and his weregeld was much higher than that of any other artificer. In the Welsh court the king's smith sat next to the domestic chaplain, and was entitled to a draught of every kind of liquor that was brought into the hall:" a privilege which many artificers of his class in our own day would not be disposed to make light of!

## MISCELLANIES.

*Improved Church Bell.*—A new species of Church Bell or Gong, has just been invented by a Blacksmith in Thuringia, which is much less expensive than the ordinary Church Bell, but is nevertheless quite as powerful. This Bell consists of three bars of steel forming a triangle.—*Athenæum.*

[We wish the Athenæum had told us how it was made more particularly. A triangle can hardly be called a bell.]

*New Cabs.*—Within the last few months, the public Cabriolets have undergone a greater number of alterations than perhaps any species of vehicle ever did before in so short a time. The original cabs, imported from Paris, had many disadvantages. Although pleasant enough for riding in, one could never make certain of not being thrown out and hurt before we got to our journey's end. Accidents of this kind occurred so frequently, that Mr. Hansom's alteration—lowering the body of the cab, and letting the driver sit above the heads of his fare—was very justly considered a great improvement, so far at least as the safety of the public was concerned. The drivers of these cabs however, appear in constant danger of being thrown over their horses' heads, and although it does not seem that many serious accidents of this kind have happened; and that any objection can consequently be taken to the cabs on this ground, yet they are too heavy—they appear too clumsy—ever to come into general use. Another kind of cab is that in which the passengers sit opposite each other, and side way to the horse, the entrance being behind, with one step. This cab will probably soon supersede all the rest; it has however already undergone six or seven alterations; and probably an improvement will soon be made in the construction of the wheels, which appear as much too small as those of Hansom's are too large. The cab, however, is the most light and graceful kind of vehicle that has ever yet appeared in the streets of London. It is quite safe, and travels through the streets very rapidly. A kind of cab chariot was brought out by a "Safety Cab Conveyance Company," about the time the first alteration was made in the cabs, but it does not appear to have succeeded very well, if we may judge by the small number that are seen in the streets. Altogether, not less than a dozen different kind of cabs may now be seen in London, and nearly all have been introduced within the last six months!

*School for Design.*—Our readers will recollect that a parliamentary grant of £1500 was made some time since, for the purpose of establishing a school of design for the instruction of artizans and others, "in such of the fine arts as are peculiarly applicable to the different manufactures of this country." The school we are happy to say will be opened for the reception of students on the 1st of June next. It will be held in the rooms at Somerset House, lately occupied by the Royal Academy, and the hours of attendance, at first, will be from ten till four, but as it is evident that very few artizans can afford to attend in the day time, of course the school *must* be open in the evening, if it is intended to be of any service at all. It is stated that arrangements are in contemplation for opening an evening school. The subscription required from each student is *four shillings* per week. Any person wishing to attend the school, must apply to the director, J. B. Papworth, esq., at Somerset House, either personally or by letter (post paid) any Monday, Wednesday, or Friday, between ten and four o'clock.

Digitized by Google

*National Monuments, and Works of Art.*—We beg to call the particular attention of our readers to a meeting that will be held on Monday next, the 29th inst., at one o'clock, at the Freemason's Hall, Great Queen Street, Long Acre, to take into consideration the propriety of petitioning his majesty and both houses of parliament, on the advantages of admitting the public, free of expense, to all depositions of national monuments and exhibitions of art in national buildings, especially to Westminster Abbey, St. Pauls, and the annual exhibition of native talent in the New National Gallery. Perhaps nothing has done more to prevent our artizans acquiring those correct principles of taste for which the workmen on the Continent are deservedly celebrated than the system of exclusion, to petition against which the meeting is called. We have no doubt a petition from a numerous meeting would be attended with success. In the list of committee for effecting the desired object we are happy to perceive the names of some of our best artists, and many members of parliament. George Foggo, Esq., the historical painter, is the secretary. We sincerely trust the meeting will be well attended, and that it will soon effect the object for which it is called.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, May 31, Dr. Birkbeck, on Osteology.——Friday, June 2, Mr. T. Phillips, on Sacred Music, with Illustrations, both at half-past eight.

*Aldersgate-street Institution*—Wednesday, May 31, C. Johnson, esq., on Vegetables used in Medicine, and the Arts, at eight.

*Eastern Athenæum.*—Wednesday, May 31, E. Slatterie, esq., on Elocution, at eight.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge Road.—Tuesday, May 30, A *Conversazione*, at half-past eight.

*Poplar Institution*, East India Road.—Tuesday, May 30, Col. Thompson, M. P., on Political Economy—the Currency, at eight.

*Eastern Literary and Scientific Institution*, 88, Hackney-road,—Tuesday, May 30, J. Mitchell, esq., on Roman Antiquities, at eight.

*Mutual Instruction Society*, Great Tower-street.—Monday, May 29, Mr. A. Lee, on the Formation of the Skull, at eight.

*Temperance Mechanics' Institution*, Aylesbury-street, Clerkenwell, Monday, May 29, Mr. Hatch, on the Character and Poetry of Mrs. Hannah More, at a quarter-past eight.

*Kentish Town Mutual Instruction Society.*—Monday, May 29, M. Collis, on the Atmosphere, at half-past eight.

*Bermondsey Mutual Instruction Society.*—Monday, May 29, Quarterly General Meeting, at a quarter-past eight.

*Mechanics' Institution*, New Road, near Gower Street.—Tuesday, May 30, Mr. Guthrie, on Astronomy, at eight.

*Finsbury Mutual Instruction Society.*—Tuesday, 30, Mr. Nichols, on Entomology, at half-past eight.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Waterproof Cloth.*—SIR, Will you oblige me by inserting in your Periodical the manner of Making Cotton Cloths Waterproof, which when dry shall be neither greasy, nor have any smell arising from them.

Yours obediently. H. B.

*Work on Flax Factory.*—SIR, Would you be kind enough to inform me, through the medium of your valuable Magazine, of some of the Latest Works upon a *Flax Factory*, comprising the cultivation of Flax and Hemp, Hackle and Spinning Machines, Looms, Weaving, Bleaching, &c.

You would oblige very much,
One of your Subscribers.

### ANSWERS TO QUERIES.

*Copper-Plate Ink.*—This composition is made by mixing the best *Frankfort Black* with about sixteen times its quantity of drying *hut* or Linseed Oil. "A Young Printer," however, is recommended to seek the shop of Messrs. Wood and Sharwoods, Aldersgate-street, who deal in Ink and all other materials used by Copper-Plate and other Printers.

C. D. F.

*Gold and Silver Inks* are made by rubbing the leaf metal with Honey in a mortar until it becomes a very fine powder. The honey is then washed away from it, and thin gum-water added to the powder, when it is fit to write with. Dutch gold-leaf, may be used instead of gold-leaf, and will be much cheaper.

C. D. F.

## TO CORRESPONDENTS.

*We shall be glad to hear again from* H. E., *the paper shall be inserted.*

A Constant Reader. *The communication shall be inserted with a note on the subject next Week.*

J. C. *We do not intend to increase the size of our pages, which would prevent the Numbers being bound together. His suggestion shall be attended to.*

G. Horsfall. *Brandy will not dissolve Gold. The answer is not a good one.*

Mr. Rough's *communication shall receive our early attention.*

*If* Mr. Hatch *will forward us a List of the Lectures of the* Temperance Association, *we will Publish them with those of other Institutions.*

Tiles's *Queries very properly ridicule many that we are in the habit of receiving. We have more than once had stranger questions proposed to us, than* how to form the Mixture of Blacking Bottles.

Mr. Douglas's *article on his Improved Steam Boilers, shall be inserted, if possible, next week.*

*We are much obliged to* Mr. Thomas.

Brack's Brother.—China.—W. B.—*and* J. R. Watts, *Received, and shall be attended to.*

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers

Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXXII.] SATURDAY, JUNE 3, 1837. VOL. I.

(ENLARGED NUMBER.)


## CONSTRUCTION OF ARCHES.

FIG. 1. FIG. 2.

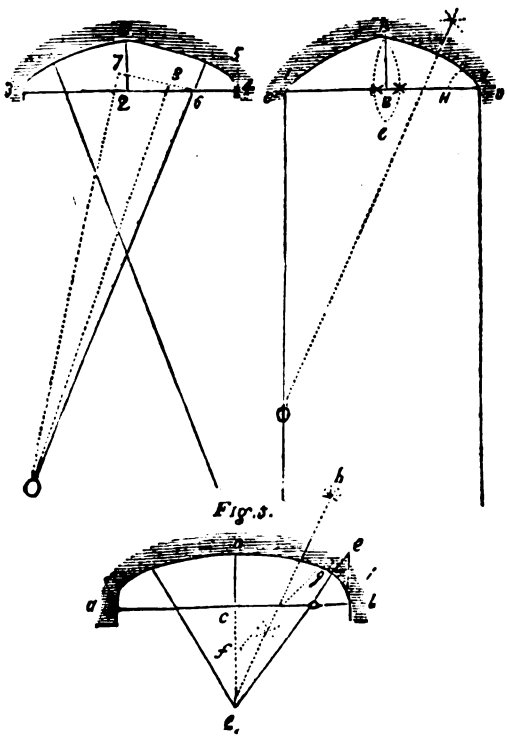


Fig. 3.




VOL. I.—No. XXXII. Holloway Press: D. A. Doudney.



Digitized by Google

## CONSTRUCTION OF ARCHES.

*To the Editor of the* PENNY MECHANIC.

SIR,—I have frequently observed many of my fellow-workmen in the building-line greatly at fault in setting out a Gothic, or an Elliptic arch; and in the majority of cases, after bothering their brains a long time, it is at last accomplished by what is technically termed *scowl* of *brow*, and *line* of *thumb*. I send you three figures, for which if you could find room in your valuable Periodical, (which I believe is gaining a large circulation among the class I allude to) you would much oblige

A. M.

DESCRIPTION OF ENGRAVINGS.

Fig. 1. Let 1, 2, be the height; and 3, 4, the width of the arch. Draw 4, 5, perpendicular to 3, 4, and equal to two-thirds of the height; describe the arch 5, 6, draw 5, 1, and from the point 1, let fall the perpendicular 1, 0, make 1, 7, equal to 4, 5, draw 6, 7, and besect it with the perpendicular 8, 0, cutting 1, 0, in 0, and 6, 0, will be the centres required.

Fig. 2. A, B, the height, and C, D, the width of the arch; with C, D, as centres, extend your compass to A, and describe the arc's A, E; then with the distance X X draw the small arc's C, 1, and D, 1; besect A, 1, with the perpendicular F, 0; draw C, 0, perpendicular to C, D, cutting F, 0, in 0, and 0, H, will be the centres required.

Fig. 3. To describe a semi elipsis or elliptic arch. *a*, *b*, the tranverse or length; *c*, *d*, the conjugate or height; draw *b*, *e*, parallel and equal to *c*, *d*; divide *b*, *e*, into two equal parts at *i*, draw the line *d*, *i*, extend the conjugate and prick down the height at *f*, draw the line *f*, *e*, besect the distance *d*, *g*, on the line *d*, *i*, with the perpendicular *h*, *l*, cutting the line *d*, *f*, in *l*, and *l*, *o*, will be the centres required.

## STEAM BOILERS.

NO. I.

*To the Editor of the* PENNY MECHANIC.

SIR,—Having purchased Number 21 of your Magazine of the Arts and Sciences, upon opening it I was not a little surprised to find therein a controversy between your worthy correspondents, Mr. King and Mr. Puttich, regarding my invention, for Preventing the Explosion of Steam and other Boilers. I purchased your prior numbers, and in Number 7 I found you had given an insertion of part of my specification and drawing; also an editorial article, which I acknowledge and duly appreciate. You will oblige me much if you will give this a place in your columns, that the mistaken notions of Mr. King and Mr. Puttich may be corrected. These gentlemen do not seem to be aware that the water-cisterns and air-tubes shown by the engravings in Number 7, are not intended for the purpose of feeding or supplying the requisite quantity of water consumed by evaporation, but merely showing the way that either water, or air, may be applied; but the one or the other is absolutely necessary, and should be ready to rush in under the water the moment it is forced from the heating surface, that the rarefied vapour which has attained to a greater power of elasticity than the steam, and the gravity of the water, may be partially condensed. By this means the water will be enabled to return instantly to the heating surface, and prevent the formation of the explosive gases; which is the cause of all the explosions of steam boilers, and not steam, as erroneously imagined. My claim is solely for the application of what I know to be perfect preventives of the explosion of steam-boilers. First, in guarding against internal pressure, as shown by the drawing in Number 7; fig. 1, I convert the safety-valve beam into a lever of the first order; it is a self-acting apparatus, by the application of a piston wrought in a perfect cylinder, which is placed upon the boiler roof, and the moving piston becomes a portion of it. A steel-yard is connected to the one side of the piston, as it is pressed up by the steam it pulls the spring which shows every pound pressure the steam attains, and the end of the lever is connected to the other side of the piston rod. When the index has attained to the given pressure, the piston rod acts instantly upon the end of the lever, which lifts the safety-valve, and allows the surplus steam to escape, which takes the power off the piston, and the valve closes. This apparatus may be cased, and locked up. It requires no attention from the engineer, nor is it necessary to be puffing off the steam at every stoppage of the engine, for it cannot attain to a greater degree of elasticity than the given power. At the same time the engine is enabled to start with a full head of steam. The water also is kept upon the heating surface, by the pressure of the steam above it, which keeps the metal from being oxidized, and of course the boiler from exploding.

Secondly, In guarding against *external* pressure as shown by the drawing in Number 7, fig. 1, 2, 3, K, O, S, Q, represent four valves, all of which open inwardly.

Digitized by Google

When the internal pressure is reduced by either condensation of the rarefied stratum of vapour under the water, or the combustion of the gases, which frequently occupy the same place, a partial vacuum is produced, and the valve is pressed open by the weight of the incumbent atmosphere. The water or the atmosphere (as it may be) will then flow into the boiler under the water, which has been forced up into the steam reservoir. The pressure of the vapour having been less above the water, than that below it, the incumbent atmospheric weight having been forced out of the boiler by the first discharge of steam, only rests upon the external surface of the boiler. The water is left entirely to the fluctuating elasticity of the vapour upon its surface. And if that is suddenly removed by either opening the cylinder safety-valve, or steam cock, the elasticity of the steam above the water is reduced very much below that which is under the water. This permits it to expand itself, by means of which the water is driven up into the steam reservoir in a body. At this moment the atmospheric weight presses open the valve, and the water or air rushes into the boiler, and partially condenses the vapour that is under the water which restores an *equilibrium*, and the water instantly returns to the surface of the heating metal, this prevents it from attaining that degree of temperature which is capable of decomposing the water, and forming it into hydrogen and oxygen gas. When ignited by the electrical spark passing from the body positively electrified, which at this instant is the vapour, to the body negatively electrified, which is the hot metal; but by means of the drops of water which are falling from the watery clouds above, and formed into explosive gas, the metal is partially cooled, which gives it an affinity for electricity. The water is supported up against the roof of the boiler similar to a column of water that is supported in a syphon tube, while the thumb remains upon the orifice of the tube, the weight of the atmosphere being equal to a column of water about thirty-three feet high, it cannot descend while the thumb remains upon the orifice. It is also by a similar principle, that a drop of water is supported at the eaves of houses, and at the points of the leaves of plants, &c. Or by filling a tumbler with water and covering it with paper, and then turning gently the bottom up, the water will be sustained in the tumbler. A boiler is only a tube of a large dimension, and of a different form; but the water and vapour is encompassed by the metal in the very same manner, and cannot be driven to the right nor to the left when permitted to expand under the water, by any sudden reduction of the pressure upon its upper surface. If the internal pressure is a little more than the external, it cannot enter the boiler, and if the safety-valve were to continue open for a short time, and the fire kept up, the rarefied stratum would very soon have possession of the whole boiler, by forcing the water out of it. This fact of the water being not only driven from the bottom, but the whole being forced out of the boiler, is stated in the Franklin Institute, Vol. 8, Number 3, p. 145—6. "It was stated by one of the newspapers that upon the trial of a model-engine, the steam was raised in a small high-pressure boiler, the safety-valve of which was lifted by hand, the steam was immediately followed by water, and ultimately the whole of the water in the boiler was expelled through the valve, and a solution of the phenomena was required." Having quoted the above Mr. Franklin, Peale says, "This is a fact of immense importance in the management of an engine, and yet it is one that was not anticipated by men of science, and of which even practical engineers were uninformed. In company with several engineers, and other gentlemen of science, at a recent trial of a locomotive engine, I was witness to a case exactly in point; it was in action without locomotion, the wheels being raised so as to prevent adhesion, and the gage cocks all indicated water, the engine was then stopped; when, to the surprise of those present, no water was found at the lowest cock, and no human being could ascertain what was the height of water in the boiler at that time, a circumstance that should never occur, for reasons that every one who has any knowledge of the subject must know and admit."

I am apprehensive you will think this communication too long, which obliges me to desist from adding any more at present.

I am, Sir,
Your most obedient Servant,
JOHN DOUGLAS.

## LIGHTNING CONDUCTORS.

*To the Editor of the Penny Mechanic.*

SIR,—In answer to your correspondent "N. O'mel, page 240," I think that buildings might be protected from the effects of lightning, by fastening to the highest parts of such buildings glass rods with metallic points, having a communication by chains to one of Dr. Franklin's metallic rods,



Digitized by Google

the points at the top of the glass rods would draw the electric fluid from the clouds, and as glass is a non-conductor, it is obvious that it would be conveyed by the chains to Dr. Franklin's rods, by which it would be silently conducted to the ground. Care should be taken that the chains do not touch any part of the building. If you think this worthy of a place in your valuable work, I shall be obliged.

I am, Sir,
Yours truly,
J. R. Watts, M. D.

[We do not think either the suggestion of Mr. N. O'Mel, or of Mr. Watts, any great improvement on Dr. Franklin's conducting rods. An electrical kite might be useful, if it could always "be kept floating over a range of buildings," but it might be hanging down at the very time it ought to be flying about. One good conductor, made of a stout rod of iron, with a number of long branches, over different parts of a building, would perhaps be preferable to either of the plans proposed. Indeed, Mr. Watts merely suggests that these rods, or chains, should be supported on glass pillars, which might be preferable to having them depend for support on the upright rod alone.—Ed. P. M.]

## ARITHMETICAL PUZZLE.

*To the Editor of the Penny Mechanic.*

Sir,—In the Arithmetical Puzzle, page 239, Penny Mechanic, Snubby Gong says "when there is *no* remainder, *nine* is the figure struck out." Allow me to ask your ingenious correspondent, how it follows *of course*, that nine was the figure struck out in the following examples?

| | |
|---|---|
| 1234 | 2143 |
| 9 | 9 |
| 11106 | 19287 |
| 5 | 7 |
| 5553(9) | 135(0)09 |

the sum of each being 18, and divided by 9, leaves no remainder. Now, according to the rule, nine should be the figure struck out; but, in fact, the omission, in each example, was the nought.

W. B.

## JEFFREYS' PATENT RESPIRATOR.

In consequence of the great variation that frequently occurs in the temperature of the atmosphere of this country, we are more subject to disorders of the pulmonary organs than perhaps any other nation on the earth. Indeed the majority of deaths in this country arise from consumption; or disorders which are produced from a diseased state of the lungs. Now there can be no doubt but that many of these disorders could be prevented by a little caution. Delicate young ladies, and invalids, who are predisposed to consumption, are very frequently in the habit of passing out of a warm room at once into the cold atmosphere of the street, perhaps many degrees below that of the room they have been in, without taking any precaution to guard against the injurious effects that must naturally be produced by such conduct. It is only when the dreadful scourge of this country, consumption, begins to exhibit some of its terrible symptoms, or, perhaps, when it has gained such a firm hold of the unhappy patient, that all aid is useless; it is only then that alarm is felt, and means taken to prevent any circumstance contributing to assist the progress of the disease. One of the principal of these predisposing causes, as we have just stated, is the sudden change in the temperature of the air to which many persons so thoughtlessly expose themselves, and Mr. Jeffreys has invented a very ingenious and elegant piece of apparatus by which the evil may be almost entirely remedied. The instrument consists of a little case of metallic bars, placed close to each other, and it can be fitted to the front of the mouth without inconvenience. The patentee in his prospectus, says "The attention of all persons who are distressed by breathing cold air—of asthmatic and consumptive persons in particular—is requested to this small and delicate instrument. It is worn over the mouth, and is so neatly finished as to be in no way disfiguring. It does not at all obstruct the passage of the breath, nor affect the voice. The lowest whisper, audible without the instrument, is heard equally well when it is on. The metallic packet, in which the action lies, is made partly of pure silver, and partly of metal, coated with gold and silver. The materials are, therefore, incorrodible, and will last for many years. *The action of this instrument is to warm the air before it is drawn into the lungs.* The wearer of it can go abroad in the coldest weather, and breathe air warmer than that of summer; or he can have the air he inhales raised to the temperature of mild spring weather. For the former purpose a packet of double action is put into the case; for the latter purpose one of single action is used. The principal upon which the Respirator acts is the following: it allows

Digitized by Google

the impure air of the breath to pass freely through it, retaining none of it, but it *abstracts from the breath, while passing, all its warmth*, which is effected in a very complete manner, owing to the nature and arrangement of its materials, on philosophical principles. This pure warmth is accumulated in the instrument, and is soon sufficient to warm thoroughly the cold air entering through it, every time the breath is drawn."

It will be seen from this description that the efficacy of the instrument depends upon its being able to absorb the heat of the breath passing *from* the lungs, and give it out to the cold air passing *to them* during inspiration. Mr. Jeffreys has constructed the instrument of the best materials probably that could be employed for this purpose, but as they are very expensive, the instrument is necessarily so, and consequently the use of what we consider to be an instrument of public utility, will be restricted almost entirely to those who can afford the sum necessary to purchase one (from two to three pounds). There are other materials which however for a time may be made to answer the purpose of "the Respirator;" and although we should be exceedingly sorry to deprive Mr. Jeffreys of any of the pecuniary rewards to which his ingenuity is so well entitled, still, as we think the invention calculated to be the means of preserving many lives that must otherwise undoubtedly perish, we think that even he will not object to our pointing out a means by which the principle of his invention may be adopted with cheaper materials, and thus enable those who cannot afford to purchase "a respirator" to form one cheaply for themselves, though not so elegant or durable as those manufactured by him. We think if three or four pieces of thin *gauze wire* were laid upon each other, and folded up lightly in a gauze handkerchief, or a piece of black net or muslin, that if this were then tied over the mouth, as a handkerchief might be, it would to a great extent act as effectually as the respirator in warming the air inspired. The metallic wire of which the gauze is composed would become warm after one or two expirations of the breath, and then it would warm all the air that passed through it into the lungs. Of course it would only be temporary, and would most likely prevent conversation, but as a cheap application of the principle adopted by Mr. Jefferys, we think it is worth a trial. We are glad to see that some of the most eminent physicians and surgeons of the present day warmly recommend "the Respirator," amongst them are the names of Dr. Arnot, Sir B. Brodie, Sir A. Cooper, Dr. Elliotson, Mr. Travers, and many other eminent men.

## STEAM-BOAT VENTILATION.

*To the Editor of the* PENNY MECHANIC.

SIR,—Ventilation, which should be one of the first principles, if not the first, in constructing any thing intended to contain animal life, appears to me to be but imperfectly attended to in this age of general improvement, although certainly much better now than formerly.

My attention was called to this subject by being, a few days ago, on board one of the river steamers. The day was rainy and, consequently, all the passengers resorted to the cabins. I was in the fore-cabin with about seventy others—some were smoaking—and the only vents which I could perceive for the breath of all these persons and the tobacco smoke were the cabin staircase and the chimney. There were windows to be sure, but, as it frequently happens, it was not agreeable to all parties to have any of them open. The river steamers appear to me to be built exclusively for fine weather. Perhaps these few words, or a few from your own able pen, may have some effect on the architects, who, it is to be hoped, will speedily adopt some method for effectually remedying the evil complained of.

I am, Sir,
Yours obliged,
J. F. S.

## CHEAP ELECTRICAL APPARATUS.

*To the Editor of the* PENNY MECHANIC.

MR. EDITOR,—The following is a simple method of exciting and collecting electricity, by means of which a number of curious and instructive experiments may perhaps prove acceptable to some of your readers. Take a quarter of a sheet of coarse brown paper (the coarser the better), and hold it before the fire till it becomes quite hot, then lay it on a piece of dry flannel folded two or three times, or on the horse-hair bottom of a chair, and rub it briskly in one direction with a piece of flannel, or the sleeve of your coat for a few seconds, then on lifting it up by one corner, and bringing the knuckle near it, a crackling sound will be heard; and if performed in a dark room several beautiful flashes of electric light branching out, like trees bare of leaves, will be seen passing from the paper to the knuckle. Thus by simply rubbing a piece of warm paper, we may actually produce the phenomena of thun-



Digitized by Google

der and lighting, the pale flash of light being identical with the forked lightning, and the crackling sound with the awful and majestic thunderclap.

So much for exciting the electricity. To collect it in sufficient quantities to give the shock, and perform the experiment, procure a common eight-ounce apothecary's phial, and line it inside and out to within a short distance of the neck with tinfoil, which may be had at any optician's or tinman's: two-penny-worth will be found more than sufficient for the purpose. It may be stuck on with gum or paste, and for putting it in the inside, it should be cut into slips, or it will be very difficult to get it to stick; insert in the cork of the phial, a piece of wire, and bend it round so as to touch the tinfoil on the inside; let the other end of the wire project a little way above the top of the cork; and bend it round, as points have a tendency to throw off the electricity. Your apparatus is now complete, and will not altogether cost more than sixpence at the utmost.

Having warmed your leyden phial (as it is called) proceed to rub the paper as before directed, and hold it just over the wire in the cork; the electric fluid will be seen and heard flashing to the wire. Repeat this about twenty times, your bottle will then be charged; take it up in your hand, and apply it to one of the knuckles of your other hand, or to your nose, and you will have a pretty smart shock; indeed, few of my friends are willing to try a second: with this simple apparatus I have succeeded in performing a number of interesting experiments, as the thunder-house, combustion of spirits, &c., and above all in making very powerful magnets of sewing needles and small pieces of steel. It is necessary in all experiments with the leyden phial to make a connexion by touching the tinfoil on the outside, at the same time you touch the wire, the shock passing through the connecting substance.

I am, Sir,
Your obedient Servant,
J. H.

## LIGHT AND VISION.

NO. I.

THE nature of light has always been involved in considerable doubt and mystery. The ancients could scarcely be said to have any opinion on the subject, unless, indeed, it could be considered such to affirm that distant bodies could not be put into communication without an intermedium; and that, therefore, there must be something between the eye and the thing seen. What that something is, however, they could only form crude and vague conjectures. One supposed that the eyes themselves emit rays or emanations of some unknown kind, by which distant objects are as it were felt; a singularly unfortunate idea, since it gives no reason why objects should not be equally well seen in the dark—no account, in short, of the part performed by *light* in vision. Others imagined that all visible objects are constantly throwing out from them, in all directions, some sort of resemblances or spectral forms of themselves, which, when received by the eyes, produce an impression of the objects. Vague and clumsy as this hypothesis obviously is, it assigns to the object a power, and to light a diffusive propagation in all directions, which are, the one and the other, independent of our eyes, and therefore goes to separate the phenomena of *light* from those of *vision*. The hypothesis of Newton is a refinement and improvement on this idea. Instead of spectra or resemblances, he supposes luminous objects actually to dart out from them in all directions, particles of inconceivable minuteness (as indeed they must be, having such an enormous velocity, not to dash in pieces every thing they strike upon). These particles he supposes to be acted upon by attractive and repulsive forces, residing in all material bodies, the latter extending to some very small distance beyond their surfaces; and by the action of these forces to be turned aside from their natural straight-lined course, without ever coming in actual contact with the particles themselves of the bodies on which they fall, but either being turned back and *reflected* by the repulsive forces before they reach them, or penetrating between their intervals, as a bird may be supposed to fly

Digitized by Google

hrough the branches of a forest, and undergoing all their actions, to take at quitting them a direction finally determined by the position of the surface at which they emerge with respect to their course. A very different hypothesis had, however, been suggested about the same period by Huyghens, who supposed light to be produced in the same manner with sound, by the communication of a vibratory motion from the luminous body to a highly elastic fluid, which he imagined as filling all space, and as being less condensed within the limits of space occupied by matter, and that to a greater or less extent, according to the nature of the occupying substance. Thus, in place of any thing actually thrown off, he substituted waves, or vibrations, propagated in all directions from luminous bodies, through this medium, or ether, as he called it. Huyghens, being himself a consummate mathematician, was enabled to trace many of the consequences of this hypothesis, and to show that the ordinary laws of reflection and refraction were represented or accounted for by it, as well as by Newton's. But the hypothesis of Huyghens has not been fully successful in accounting for what may be considered the chief of all optical facts, the production of colours in the ordinary refraction of light by a prism, of which the theory of Newton gives a complete and elegant explanation; and the discovery of which by him marks one of the greatest epochs in the annals of experimental science. This, which has been often urged in objection to it, remains still, if not quite unanswered, at least only imperfectly removed. Other phenomena, however, were not wanting to afford a further trial of the explanatory powers of either hypothesis. The diffraction or inflection of light, discovered by Grimaldi, a Jesuit of Bologna, seemed to indicate that the rays of light were turned aside from their straight course by merely passing near bodies of every description. These phenomena, which are very curious and beautiful, were minutely examined by Newton, and referred by him to the action of repulsive forces extending to a sensible distance from the surfaces of bodies; and his explanation, so far as the facts known to him are concerned, appears as satisfactory as could reasonably be then expected; and much more so than any thing which could at that time be produced on the side of the hypothesis of Huyghens, which, in fact, seemed incapable of giving any account whatever of them. Another class of delicate and splendid optical phenomena, which had begun to attract attention somewhat previous to Newton's time, seemed to leave both hypotheses equally at a loss. These were the colours exhibited by very thin films, either of a liquid (such as a soap-bubble), or of air, as when two glasses are laid together with only air between them. These colours were examined by Newton with a minuteness and care altogether unexampled in experimental philosophy at that time, and with which few researches undertaken since will bear to stand in competition. Their result was a theory of a very singular nature, which he grounded on an hypothesis of what he termed *fits of easy transmission and reflection*; and which supposed each ray of light to pass in its progress periodically through a succession of states such as would alternately dispose it to penetrate or be reflected back from the surface of a body on which it might fall. The simplest way in which the reader may conceive this hypothesis, is to regard every particle of light as a sort of little magnet revolving rapidly about its own centre while it advances in its course, and thus alternately presenting its attractive and repulsive pole, so that when it arrives at the surface of a body with its repulsive pole foremost, it is repelled and reflected; and when the contrary, attracted, so as to enter the surface. Newton, however, very cautiously avoided announcing his theory in this or any similar form, confining himself entirely to general language. In consequence, it has been confidently asserted by all his followers, that the doctrine of fits of easy reflection and transmission, as laid down by him, is substantially nothing more than a statement of facts. Were it so, it is clear that any other theory which should offer a just account of the same phenomena must ultimately involve and coincide with that of Newton. But this, as we shall presently see, is not the case, and this instance ought to serve to make us extremely cautious how we employ, in stating physical laws derived from experiment, language which involves any thing in the slightest degree theoretical, if we would present the laws themselves in a form which no future researches shall modify or subvert. A third class of optical phenomena, which were likewise discovered while Newton was yet engaged in his optical researches, was that exhibited by doubly refracting crystals. In what the phenomenon of double refraction consists, we have already had occasion to explain. The fact itself was first noticed by Erasmus Bartolin in the crystal called Iceland spar; and was studied with attention by Huyghens, who ascertained its laws, and referred it with remarkable in-

Digitized by Google

genuity and success to his theory of light, by the additional hypothesis of such a constitution of his ethereal medium within the crystal as should enable it to convey an impulse faster in one direction than another: as if, for example's sake, we should suppose a sound conveyed through the air with different degrees of rapidity in a vertical and horizontal direction. Some remarkable facts accompanying the double refraction produced by Iceland spar, which Bartolin, Huyghens, and Newton, had observed, led the latter to conceive the singular idea that a ray of light after its emergence from such a crystal acquires sides, that is to say, distinct relations to surrounding space, which it carries with it through its whole subsequent course, and which give rise to all those curious and complicated phenomena which are now known under the name of the *polarization of light*. These results, however, appeared so extraordinary, and offered so little handle for further inquiry, that their examination dropped, as if by common consent; Newton himself resting content with urging strongly the apparent incompatibility of these properties with the Huyghenian doctrine, but without making any attempt to explain them by his own. From the period of Newton's optical discoveries to the commencement of the present century, no great accession to our knowledge of the nature of light was made, if we except one, which, from its invaluable practical application, must ever hold a prominent place in the annals both of art and science: we mean, the discovery of the principle of the achromatic telescope, which originated in a discussion between the celebrated geometer Euler, Klingenstierna, an eminent Swedish philosopher, and our own countryman, the admirable optician Dolland, on the occasion of certain abstract theoretical investigations of the former, which led him to speculate on its *possibility*, and which ultimately terminated in its complete and happy execution by the latter: a memorable case in science, though not a singular one, where the speculative geometer in his chamber, apart from the world, and existing among abstractions, has originated views of the noblest practical application.*

* There seems no doubt, however, that an achromatic telescope had been constructed by a private amateur, a Mr. Hall, some time before either Euler or Dollond ever thought of it.

## LIST OF PATENTS.

ENGLISH.—MACHINERY.

*Austin, Edward*, of Warwick-place, Bedford-row, for an improved method of raising sunken vessels. From 12th May, for six months.

*Barker, Joseph*, of Regent-street, Lambeth, for improvements in making umbrellas and parasols. From 29th April, for six months.

*Baylis, Thomas*, of Tamworth Stafford, Civil Engineer, for improvements in heating and evaporating fluids. Communicated by a foreigner residing abroad. From 6th May, for six months.

*Bell, William*, for same purpose. From 11th May, for six months.

*Boydell, James, Jun.*, of Dee Cottage, near Hawarden, Flint, for improvements in propelling carriages. From 11th May, for six months.

*Debae, Pierre Barthelemis Guinibers*, of Brixton, Surrey, Civil Engineer, for improvements applicable to railroads. From 13th May, for six months.

*Devaux, Charles Pierre*, of Fenchurch-stteet, for an improved apparatus for preventing explosions of boilers, or generators of steam. Communicated by a foreigner residing abroad. From 23rd May, for six months.

*Freeman, Charles Joseph*, Frederick Place, Surrey, for improvements in rolls for rolling iron, &c. From 25th May, for six months.

*Hayman, George*, Sidwell-street, Exeter, for improvement in two-wheel carriages, from 6th May, for six months.

*Hague, John*, Castle-street, Wellclose-square, Engineer, for improvements of wheel for carriages. From 10th May, for six months.

*Heathcoat, John*, Tiverton, Devon, Lace Manufacturer, for an improved method of manufacturing ornaments and figures upon gauze, muslin, &c., and also certain apparatus to be used in manufacturing such ornamented work. From 4th May, for six months.

*Ingrand, Thomas Wells*, Birmingham, for improvement in the manufacture of certain descriptions of buttons, and in the tools used in manufacturing the same. Communicated by a foreigner residing abroad. From 4th May, for six months.

*Leak, Elijah*, of Hanley, Stafford, for certain improvements in the construction of shutters and sashes for windows, and in the fitting and using the same. From 23rd May, for six months.

Digitized by Google

*Nairne, William*, of Millhaugh, near Methven, Perth, for certain improvements in the machinery of reels, used in reeling yarns. Communicated by a farmer residing abroad. From 8th May, for six months.

*Rhodes, William and Robert Hamingway*, both of Earls Heaton, near Dewberry, York, for improvements applicable to machinery for carding and piercing wool, in process of manufacture of woollen mills. From 22nd May, for six months.

*Robertson, William Angus*, of Peterborough-court, Fleet-street, for improved machinery for sculpturing and otherwise fixing and working marble, &c., and for taking copies of the work produced thereby, or by the ordinary means; and also an improved method of taking casts of the living human face or other form. Communicated by a foreigner. From 6th May, for six months.

*Steinkeller, Peter*, of the London Lime Works, Wenlock-road, for certain plates or tiles made of lime or other mixtures, applicable to roofs. Communicated by a foreigner residing abroad. From 8th May, for two months.

*Ross, Henry*, of Leicester, for improvements in the combing of wool and goat's hair. From 6th May, for six months.

*Smith, Samuel and William*, of Luddenfoot, near Halifax, York, for improvements in machinery for combing or clearing sheep's wool and goat's hair. From 23rd May, for six months.

*Spurgin, John*, of Guildford-street, Russell-square, for an improved method of propelling vessels through water. From 8th May, for six months.

CHEMISTRY.

*Bell, Thomas*, of South Shields, Durham, for improvements in the manufacture of sulphate of soda. From 8th of May, for six months.

*Crawford, Henry William*, No. 5, John-street, Berkeley-square, for an improvement in coating iron and copper for preventing oxydation. Communicated by a foreigner. From 29th April, for six months. Patent also granted for Scotland.

*Dixon, Alexander and James*, of Cleckheaton, near Leeds, York, for improvements in dyeing. From 29th April, for six months.

*Mollerat, Jean Baptiste*, 27, Leicester-square, for an improvement in the manufacture of gas for illumination. From 2nd of May, for six months.

## PATENTS FOR SCOTLAND.

MACHINERY.

*Amesbury, Joseph*, of Burton Crescent, Middlesex, for certain apparatus for the relief of stiffness, weakness, or distortion of the human spine, chest, or limbs.

*Bunnett, Joseph*, of Newington Causeway, Southwark, for improvement in window shutters.

*Coles, William*, of Charing Cross, for improvements applicable to locomotive carriages.

*Cane, George*, of Yniscedywyn Iron Works, near Swansea, for an improvement in the manufacture of iron.

*Campbell, John Gordon, and John Gibson*, of Glasgow, for an improved process of manufacturing silk, and in combination with certain other fibrous substances.

*Hardy, James*, of Wednesbury, Stafford, for improvements in the manufacture of iron into cylindrical and other forms suited for axletrees and other purposes.

CHEMISTRY.

*Nichels, Christopher*, of Guildford-street, Lambeth, for implements in preparing and manufacturing Indian rubber, applicable to various purposes.

*Partridge, Nathaniel*, of Elm Cottage, near Stroud, Gloucester, for improvements in mixing and improving oil paints, whereby a saving of ingredients commonly used may be effected.

*Poole, Moses*, of Lincoln's Inn, Middlesex, for improvements in making fermented liquors. Communicated by a foreigner residing abroad.

*Novel Ascent in a Fire Balloon.*—A young gentleman of the name of Sneath, residing at Mansfield, has made a large fire balloon of fire-proof canvass. On Wednesday evening he was anxious to try its buoyancy, and, inflating it, took it at nine o'clock to the Bleak-hill, where he thought he had secured it to the earth. He got into the car to see what weight it would carry, when the sudden bounds given by the machine disengaged the cords, and he rose in the air. He remained in the balloon, floating about, until eleven o'clock, when the machine began to descend, and the grappling caught in a hedge near Spondon. Here, however, another difficulty presented itself: if he got out of the car the balloon would rise, so he determined to keep his seat until the next morning, when, to his great joy, he received the assistance of some countrymen about half-past four, when he packed up his ponderous machine and conveyed it to the nearest town (Derby), where it remains.

Digitized by Google

# INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, June 7. Quarterly Meeting.—Friday, June 9, Mr. T. Phillips, on Vocal Music in Dramatic effects with Select Scenes, both at half-past eight.

*Aldersgate-street Institution*—Wednesday, June 7, C. Johnson, esq., on Vegetables as subservient to the more immediate Necessities of Life, at eight.

*Poplar Institution*, East India Road—Tuesday, June 6, Col. Thompson, M. P., on the "Greatest Happiness Principle" of Bentham, at eight.

*Eastern Literary and Scientific Institution*, 88, Hackney-road,—Tuesday, June 6, A. Catherwood, esq., on Poisons, at half-past eight.

*Mutual Instruction Society*, Great Tower-street.—Monday, June 6, Mr. A. Lee, on the Structure of the Brain, at eight.

*Kentish Town Mutual Instruction Society.*—Monday, June 5, Mr. Showler, on Digestion, at half-past eight.

*Mechanics' Institution*, New Road, near Gower Street.—Tuesday, June 6, Mr. Guthrie, on Astronomy, at eight.

*Finsbury Mutual Instruction Society.*—Tuesday, June 6, Mr. Dalton, on Chemistry, at half-past eight.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—In your Magazine of the 13th instant, you bring forward some opinions of Professor Faraday's, respecting the manner persons should manage their breathing to enable bystanders to afford assistance to those who have been overcome by inhaling noxious air in cesspools, &c. Will you allow me to ask were a man so circumstanced, and were he to leave the collar fast, and draw a smock frock or a shirt over his head, would he not by that means keep so much good air near his mouth, and exclude the bad air, as would enable him to go in and out of such a place with safety? The experiment seems to me worth the trial. C. W.

### ANSWERS TO QUERIES.

*To Remove Ink Stains from Books, Linen, &c.*—Apply to the spot, muriatic acid diluted with five or six times its weight of water, and after a minute or two, wash it off: repeating the application as often as may be found necessary. Strong solutions of oxalic, citric, and tartaric acids, also effect the purpose, and being less likely than the muriatic acid to injure the fabric they are applied to, are preferable. A CHEMIST.

*To Form Carmine.*—Take three pints of water that has been boiled in a pewter vessel, into this put one ounce of finely-powdered cochineal, and keep the water boiling for about ten minutes; add then half a dram each of alum and supertartrate of potass (cream of tartar) and keep the mixture on the fire for a minute or two longer. When the gross powder has subsided the decoction is to be removed to a tall cylindrical vessel, which must be covered over, and left free from disturbance. The carmine will then settle at the bottom of the vessel. The liquor must then be gently poured off and the powder gradually dried. An inferior carmine may then be obtained from the coloured liquor poured off from the first carmine, by the addition of a solution of muriate of tin. C. D. T.

*To Form Lake.*—Boil chips of fine *Brazil* wood in water and strain the decoction, and then add to it a solution of tin in muriatic acid, (muriate of tin) which may be purchased of the drysalters. The mixture affords a fine red precipitate, which is the article required.

By precipitating by alum instead of muriate of tin, another kind of lake is obtained.

Various coloured lakes may be obtained by digesting fine Brazil wood in acids, filtering the solution, and precipitating with alum and Ammonia, or alum and potass. Ammonia, however, gives the finest lakes. C. D. T.

*Waterproof Cloth.*—India rubber is decidedly the best material for waterproofing articles of all kinds, and must be applied in solution. The best solvent adapted for common purposes is *Naphtha*, and the purer the better. One gallon of naphtha will dissolve about ten ounces of the rubber. The manner of solution is as follows. The rubber cut into very small shreds is put into the naphtha and left till it becomes very soft. The vessel containing the solvent is then gently warmed (a steam bath is best) and stirred about until the solution is quite free from any undissolved pieces of rubber, and is of an even consistency, similar to honey. It is then fit to be applied, like any other varnish, with a brush to the articles to be rendered waterproof. It will soon dry, and will not impair the flexibility of the article, or be greasey, or have any unpleasant smell. C. D. T.

*Fireworks.—Coloured Fires.*—Sir, I beg to inform "A. B. Y. Z.," that he may manufacture different coloured fires as follows:

*A Blue Fire.*—Eight ounces of meal powder, four of saltpetre, three of sulphur, and three of zinc filings.

*Green Fire.*—Sixteen ounces of meal powder, three of copper filings.

*Red Fire.*—Forty parts of dry nitrate of Ammonia, thirteen parts of finely-powdered sulphur, five parts of chlorate of potass, four parts of sulphurret of antimony; mix intimately in a mortar; the chlorate of potass should be powdered separately.

*Spar Fire.*—Nine ounces of saltpetre, four of sulphur, and three of lampblack.

The above fires are all very brilliant, and I have given the composition of them as made for the theatres. N. N.

## TO CORRESPONDENTS.

C. D. Thomas. *An article on the Practical Application of Steam to Cabs, would no doubt suit our pages. We must, however, read it, before we can make any promise that it shall be inserted.*

*We shall make use of the papers forwarded us by* Mr. Watts.

*The request of* China *shall not be forgotten.*

S. W.'s *paper on an Improved method of Baking, we will endeavour to find room for.*

Jack's Brother's kind *note to* Z. Wigo, *on Perpetual Motion, shall appear next week.*

*We should be glad to receive a clearer description of* an Improved Window Sash—*it shall be inserted.*

C. J. G. *had better get an introduction to Jack Ketch; he will explain the mechanism of* the Drop *to him.*

A Constant Reader, *next week.*

J. P. *Will find a description of the Method of Preparing a Solution of India Rubber, in one of our late Numbers.*

*Received.* H. Barwick.—W. Nichols.—A. B.—Johnson.—A Chemist.

*Several Queries and Answers must stand over.*

ERRATA, in last Number—*The signature to the two letters in last column should have been* C. D. T. *And for* Hut oil, *read* Nut oil.

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

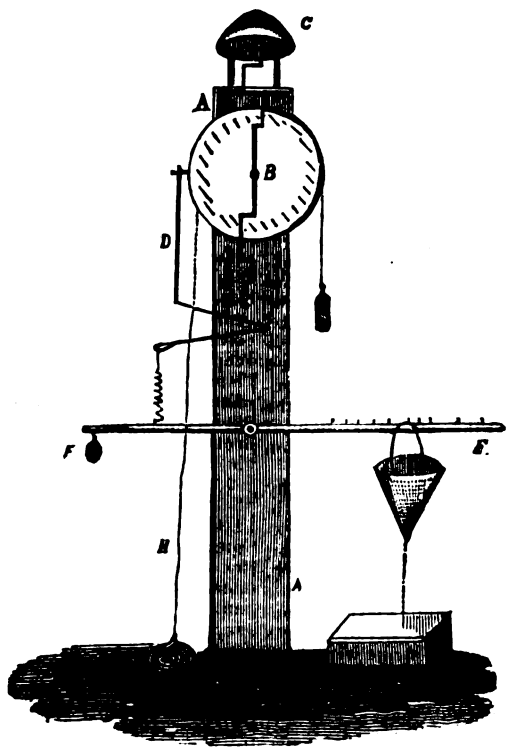
Digitized by Google

# THE PENNY MECHANIC.

## A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXXIII.] SATURDAY, JUNE 10, 1837. Vol. I.

ALARUM.




Vol. I.—No. XXXIII. Holloway Press: D. A. Doudney.

Digitized by Google

## ALARUMS.

*To the Editor of the Penny Mechanic.*

SIR,—Observing an article headed "Alarums" in the last Number but one of your Periodical, has brought to my recollection, a simple and efficient machine of that description, that I made in my *youthful* days, and which perfectly answered the purpose for which it was intended, viz. (to wake me in the mornings to join my companions on fishing excursions); and having ferretted out the description of it in one of my old copy-books, I herewith send it you, together with a diagram of the same, hoping you will favour me by their insertion, as it is some time since you have had a line from

BRACK'S BROTHER.

### DESCRIPTION OF ENGRAVINGS.

A A is a plank board about six-and-a-half feet long, six inches wide, and half-an-inch thick; which is to be fixed upright against the wall. B is a pinion wheel which may be obtained from any wooden clock-maker, under the name of "alarum pinion;" and from whom may also be had the bell C. D is a small lever connected with the regulating lever F F at one end, and presses against the alarum pinion at the other by a small spring G. The regulating lever is a piece of wood about three feet long, one-and-a-half inches wide, and about five-eighths in thickness. On one end a small weight of about three pounds is suspended, and at the other a tin cone with a minute perforation at its apex, which will contain about five pounds of sand (dried and sifted) placed in a notch agreeing with the hours required, for the sand to run out, before the machine shall strike off. The slightest inspection will now make its operation apparent.

The alarum pinion being wound up by its ratchett pully (which is not shown in diagram), by means of rope H, is prevented from running off by the lever D being pressed against it, by the spiral spring G, and as it can only be relieved by the weight end of the regulating lever preponderating, as the sand gradually discharges itself, it may be made to strike with great exactness, by timeing the distance of the cone from the fulcrum, in hours, half hours, and quarters.

## PERPETUAL MOTION.

*To the Editor of the* PENNY MECHANIC.

SIR,—From the tenor of your correspondent, "Z. Wigo's" letter, in Number 31, I should to a certainty infer that he has been practising or endeavouring to construct a machine of the description he so confidently fancies will one day be brought to perfection. And I strongly suspect that he has not been successful in his attempts, and, moreover, that some of his friends have been very unkindly, "abusing other people's thoughts," which literally means that they have laughed at him, (and I wonder how the deuce they can help it). This is, I suppose, the principal cause of his attacking us "anti-perpetualists." Z. Wigo seems to "brave it all," for he speaks boldly enough; in the course of his letter he says "now my opinion respecting perpetual motion is, that it must some time or other come into operation, if it may be called perpetual motion, for perpetual motion means to last for ever:" which in the very same sentence he flatly contradicts, for he directly says, "which I think cannot be got, for friction must overcome the motion presently." Now, in the first of these lines he states that it must some time or other succeed. It is quite plain he is positive on that point, but yet he doubts, suspects, and then very candidly tells us that "it cannot be got;" was ever any thing more absurd? except his comparison of Perpetual and Temporary, which is to follow; he says, "But if we call it Temporary Motion it would hit the mark much nearer." From this sentence we may readily take it for granted as a tacit acknowledgment of its impossibility. In comparing perpetual with temporary, we must allow that in the most ordinary acceptation of the words, that their meaning is widely different. And in the succeeding lines he again contradicts the above, for he says, "I do not see why a machine to continue in motion, while it lasts, cannot be made." So that here again he thinks it may succeed, although just before he has said, "it cannot be got." Well, he goes on again, "Some overwise persons pretend to say it cannot be come at;" he to a certainty is one of these overwise persons, for he himself has said, "it cannot be got:" this is odd enough, for I suppose both expressions amount to the same meaning. And as a kind of finisher he says, "If they were to set their wits to work properly, instead of abusing other persons' thoughts, they would, I have no doubt, some time or other find it out." Now, I should be very much obliged to "Z. Wigo," if he would condescend to inform me how to "set my wits properly to work," for I truly confess my utter ignorance of the proper method. But I am afraid that he is but an "entranced and visionary seer," who has unfortu-

Digitized by Google

nately found a "loop whereon to hang a doubt," for he constantly contradicts himself, like the unlucky "inventor" of the two Spiral Spring Perpetual Motion Machine, in one of your former Numbers, whom our friend "Brack's Brother," so quickly defeated and anatomised. In fact, Z. Wigo's letter seems written expressly for "Brack's Brother" to have "a slap at," and as I expect an able reply from him to Z. Wigo, I have not said much on the matter, having only pointed out the contradictions and futility of Z. Wigo's notions. And beg to say that Z. Wigo will, "some time or other" find it "no go." And since Brack's Brother and I are both "stamped with one iron," and each of us anti-perpetualists, I shall take the liberty of subscribing myself,

Z. Wigo's
"Overwise" Friend,
JACKS' BROTHER.

## WONDERFUL DISCOVERY.

Mr. Thomas Davenport, a Vermont blacksmith, has discovered a mode of applying magnetic and electro-magnetic power, which we have good grounds for believing will be of immense importance to the world. He has now machines in this city, which go very far to warrant the most sanguine anticipations of a total revolution in mechanics. We have not seen them, because our other avocations have prevented it, but we have read Professor Silliman's description of them, and we are convinced from that, that a new era is about to commence in these matters. We recommend to every reader a perusal of the Professor's article on this subject, in the "American Journal of Science and the Arts," for April, 1837. In the mean time we copy the best account that we have seen of the practical operation of the machine in this city, from the *New Era*, whose Editor is *au fait* in these things; only adding that Mr. Edwin Williams is agent for the patentees, and will give all required information on the subject. Who Mr. Williams is will hardly be inquired by those who know any thing about the Annual Register. 1. We saw a small cylindrical battery, about nine inches in length, three or four in diameter, produce a magnetic power of about 300 lbs., and which therefore we could not move with our utmost strength. 2. We saw a small wheel, five-and-a-half inches in diameter, performing more than 600 revolutions in a minute, and lift a weight of 24 lbs. one foot per minute, from the power of a battery of still smaller dimensions. 3. We saw a model of a locomotive engine, travelling on a circular railroad with immense velocity, and rapidly ascending an inclined plane of far greater elevation than any hitherto ascended by steam power. And these, and various other experiments which we saw, convinced us of the truth of the opinion expressed by Professors Silliman, Renwick, and others, that the power of machinery may be increased from this source beyond an assignable limit. It is computed by these learned men that a circular galvanic battery, about three feet in diameter, with magnets of a proportionable surface, would produce at least a hundred-horse power, and therefore that two such batteries would be sufficient to propel ships of the largest class across the Atlantic. The only materials required to generate and continue this power for such a voyage would be a few thin sheets of copper and zinc, and a few gallons of mineral water. Whilst the cost of this new motive power is merely nominal, it is perfectly safe and manageable. There is not a possibility of any shock or explosion, and the whole machinery might be conducted by a child. We hastily announce these important features of this incalculably important invention, preparatory to a more scientific and practical elucidation.—*New York Paper* of April 30.

[As no doubt some of our scientific friends may be able to give us some further information respecting the above, we shall feel obliged for any communications they may be pleased to favour us with on the subject.]

# BIOGRAPHICAL SKETCHES.

## JAMES TAYLOR.

CONSIDERABLE discussion has taken place since the extensive employment of steam power as a means of navigation, respecting the individual to whom the honour of first proposing it is due. This has arisen in consequence of its having been suggested more than once by individuals who neglected or were unable to bring their schemes to perfection, and make them practicable. In 1737 a person named Jonathan Hulls published "a description of a new-invented machine, for carrying vessels or ships out of, or into any harbour, port, or river, against wind and tide, or in a calm. For which his Majesty granted letters patent for the sole benefit of the author, for the space of fourteen years." This scheme was, however, never carried into practical operation, and the subject appears to have been quite neglected until Mr. Taylor, the

Digitized by Google

subject of our present sketch, again drew public attention to the matter, and was ultimately one cause of steam navigation becoming so general and so extensively useful.

James Taylor was born 3rd May, 1758, at Lead Hills, in Lanarkshire, and when about twenty-seven years of age was engaged by a gentleman of the name of Miller, of Dalwinton, as a preceptor to his sons. For some time previous to this event, Mr. Miller had been endeavouring to employ paddle wheels with vessels for the purpose of rescuing them when in danger. Taylor greatly assisted his employer in his projects, but observing that manual labour was hardly sufficient to effect the object required, it occurred to him that steam power might be employed, and by experiment he soon convinced himself of its practicability. Mr. Miller then advanced money sufficient for conducting the experiment on a more extended scale, and the result was quite satisfactory. In the very excellent, "exemplary, and instructive biography," lately published by Messrs. Chambers, of Edinburgh, there is a short but very clear account of the further proceedings of the inventor and patron, and from that work we learn that in November (1787) Mr. Miller removed as usual to the capital, where his sons attended the university under the charge of Mr. Taylor. The latter, having been empowered by his employer to proceed about the construction of an engine, recommended to Mr. Miller's notice an ingenious young engineer named Symington, who had attempted some alterations upon the steam-engine, and was now residing in Edinburgh for his improvement in a knowledge of mechanics. It was agreed that Mr. Symington should form an engine on his own plan, and that the experiment should be made in the ensuing summer upon the lake of Dalswinton. The construction of the engine occupied several months, and was not completed at the conclusion of that session of the university, so that Mr. Taylor was detained in town, to superintend the operations, for some time after his pupils had returned with their father to the country. When all was ready, he proceeded with Mr. Symington to Dalswinton, where, on the 14th of October (1788), the experiment was made in the presence of Mr. Miller and a considerable concourse of spectators. The boat was a double one, and the engine, which had a four-inch cylinder, was placed in a frame upon the deck. The experiment was successful beyond the most sanguine wishes of any of the parties concerned. The vessel moved at the rate of five miles an hour, and neither was any awkwardness found in the connection of the engine with the wheels, nor hazard apprehended in any considerable degree from the introduction of a furnace into so inflammable a fabric. The experiment was repeated several times during the course of the few ensuing days, and always with perfect success, insomuch that the invention became a subject of great local notoriety. Mr. Miller now formed the design of covering his own and Mr. Taylor's joint invention by a patent; but, in the first place, it was judged expedient, that experiments should be made with a vessel and engine more nearly approaching the common size. For this purpose, Mr. Taylor went to the Carron Foundry, with his engineer, Mr. Symington, and there, in the summer of 1789, fitted up a vessel of considerable dimensions, with an engine, of which the cylinder measured eighteen inches in diameter. In the month of November this was placed on the Forth and Clyde Canal, in the presence of the Carron committee of management, and of the parties chiefly interested. The vessel moved along very smoothly for a space beyond Lock Sixteen, when, on giving the engine full play, the flat boards of the paddles, which had been weakly constructed, began to give way; which put an end to the experiment. The paddles having been reconstructed on a stronger principle, another experiment was made on the 26th of December, when the vessel made easy and uninterrupted progress, at the rate of seven miles an hour. Except in speed, the performances on these occasions were as perfect as any which have since been accomplished by steam-vessels; and the project was now conceived by all parties to have gone through a sufficient probation, so far as the objects of inland navigation were concerned.

The expense of these experiments appear to have frightened Mr. Miller, as he would have nothing further to do in the business; and Mr. Taylor having given up the situation of teacher of his children, had not the opportunity of urging the advantages of his project so much as he could otherwise have done. In the year 1790, while the fame of the experiments was still fresh in the public mind, Mr. Taylor had some hope of introducing his invention with advantage on the Continent. Mr. Fergusson, the younger of Criagdarroch, in writing to his father from Paris, in the autumn of that year, had expressed his belief that Mr. Taylor's scheme might be taken up in Germany, and threw out a series of queries for his

Digitized by Google

own satisfaction as to its efficiency. On the 15th of August, Mr. Taylor, then residing at Leadeills, received a letter from Mr. Fergusson, senior, requesting him to come to Drumlanrig (where Mr. Furgusson then was on a visit to the Duke of Queensberry), in order to see his son's letter. Mr. Taylor answered Mr. Fergusson's queries in a letter dated September 25th; and in a reply, dated Paris, October 12th, Mr. Furgusson desired further explanations, mentioning at the same time that he had hopes of Mr. Taylor's scheme being adopted by the emperor, in order to lessen the expense of navigation up the Danube, which, owing to the current, was very great. For some time Mr. Furgusson exerted himself to attract the notice of the court of Vienna to the scheme; but all hopes of doing so were in time extinguished, in consequence of the hostilities which the emperor commenced against France. The correspondence, however, is valuable, as showing that two country gentlemen, neighbours of Mr. Miller, and who must have known the report of the country respecting the origin of the invention, regarded Mr. Taylor as the father of its principal part —the application of the steam—and addressed him as the individual properly entitled, as well as qualified, to carry the discovery into effect.

The indifference of Mr. Miller, the direction of public attention to the war which soon after commenced, and the unfavourable situation of Mr. Taylor, in an inland part of the country, and unable of himself to do any thing, conspired to throw the project for several years into abeyance. At length, in 1801, Mr. Symington, who had commenced business at Falkirk, resolved to prosecute a design, in which he had already borne an active and serviceable part. Lord Dundas employed him to fit up a small experimental steam-vessel, which was tried on the Forth and Clyde Canal, but, causing much disintegration of the banks, was forbidden by the Company to be ever set in motion again. This vessel was laid up at Lock-Sixteen, where it remained for a number of years. Mr. Symington afterwards entered into terms with the Duke of Bridgewater for introducing steam-navigation on his grace's canal; but the death of his grace unexpectedly put an end to the negociation.

Some time after, Mr. Fulton, from the United States of America, accompanied by Mr. Henry Bell of Glasgow, when on a visit to the Carron-works, waited on Mr. Symington, and inspected the boat which he had fitted up for the Forth and Clyde Canal. The consequence was, that, in 1807, the former gentleman launched a steam-vessel on the Hudson, and, in 1812, Mr. Bell another upon the Clyde, being respectively the first vessels of the kind used for the service of the public in the new and old hemispheres. Thus, after all the primary difficulties of the invention had been overcome—when the bark was ready, as it were, to start from the shore, and waited only for the master to give the word for that purpose—did two individuals, altogether alien to the project, come in and appropriate the honour of launching it into the open sea. Unquestionably, the merit of these individuals in overcoming many practical difficulties, is very considerable; yet it is clear that they were indebted for the idea to the previous inventions and operations of Messrs. Taylor and Miller, and that, if the latter gentleman had, in the one instance, been inclined, and in the other able, to carry their project into effect at the proper time, they would not have been anticipated in this part of the honour, any more than in the suggestion of the paddles and the engine.

It appears that Mr. Taylor by no means sat tamely by, while Fulton and Bell were reaping the credit due to his labours. He repeatedly urged Mr. Miller to renewed exertions, though always without success. When the vast importance of steam-navigation had become fully established, the friends of Mr. Taylor, who was not in prosperous circumstances, urged upon him the propriety of laying his claims before the government, and soliciting a reward suitable to the magnitude and importance of the discovery. At last, in 1824, he was induced to draw up a statement of his concern in the invention of steam-navigation, which he printed, and addressed to Sir Henry Parnell, chairman of a select committee of the House of Commons, upon steam-boats. He hoped that this narrative might be the means of obtaining from the government some remuneration for the services he had performed to his country; but it had no such effect. Bowed down by infirmities, and the fruits of a long life of disappointments, this ingenious man died on the 18th of September, 1825, in the 68th year of his age.

## HEAT OF THE EARTH.

*To the Editor of the* PENNY MECHANIC.

SIR,—It is an established fact that heat in air increases as its density, which is forcibly shown by the syringe which produces heat enough to ignite German tinder when

Digitized by Google

the air is suddenly compressed, forming a most useful compendium to cigar smokers, particularly whilst skating—for it matters not how cold the air, or how quick his movements. It is also well known that the higher we go the colder the air, because of its being more rarefied, and is less dense as we go up, hence the eternal snow on the summit of lofty mountains, in spite of their being nearer to the sun. I could extend this, but will go at once to the mines—fluids acting on weight always according to a column of their height as is exemplified in the first principle of hodrostatics and hydraulics, it is clear that the atmosphere in a mine must be denser the deeper we go—therefore according to our first position it must be warmer—a few experiments would very easily establish the rule, although I am not prepared to give an estimate myself. Now as to the hypothesis which maintains that the earth's centre being at a red heat is the cause of the mines being warmer the deeper we go, I should at once abandon it for this reason; first, because we have proofs that our highest mountains and aeronautical ascents approach the sun, (the source of heat) much nearer than the bottom of our mines do to the centre of the earth, still we feel a most sensible difference, the very contrary to what we ought to expect. Now after all when we reckon the greatest depth of a mine, and compare it to the earth's semidiameter it is as the thickness of a leaf, or sheet of paper, would be to a voluminous work, say the Encyclopædia Londinensis complete. Really this seems to me too trifling an approach to the earth's centre to cause any sensible difference in heat. This is a point much discussed on the Continent at this moment, and I hope I shall be able to supply your correspondent "W. E. S." with his required answer, if none of your readers should do so before me.

I am, Sir,
Yours obediently,
P. H. D.

[The density of the air does not affect its actual heat, although from its containing a greater quantity of oxygen in a smaller space than it usually occupies, it may afford more heat to animals during respiration. It is the *sudden* compression of the air by the syringe as mentioned by our correspondent, that causes the evolution of heat. All bodies when compressed into a smaller space than they usually occupy give out heat. If we mix sulphuric acid and water together, heat is given out because the mixture becomes more dense than either the acid or the water separately, but after a short time the mixture cools down to the same temperature as the liquids before they were mixed. We do not therefore think the mere density of the air will account for the heat of the earth in mines.—Ed. P. M.]

## CONVERSION OF SALT WATER INTO FRESH.

*To the Editor of the Penny Mechanic.*

Sir,—I met the other day with an extract from Commander Ross's work of his late expedition for the recovery of the whalers, respecting the easy mode he resorted to for the forming of *salt* water into *fresh*. I am sorry I neglected to make a copy of the extract; but it is very likely you have seen this account.

What I remember of the circumstance is simply this. An iron tank is placed on deck. A leaden pipe is then introduced into the tank conveying the steam from the galley boilers; whilst the steam continues to pass into the tank, it is kept cool by applying wet swabs to its exterior. In this way sixty gallons of water (as pure as that from a spring), were procured daily, being more than sufficient for the consumption.

You are aware, Mr. Editor, that even madness is occasioned from the want of water on ship-board; and you will do great service to humanity by your remarks on this useful and simple improvement. If you will add any observations on the evaporation or precipitation of the salt, &c. &c.

You will further oblige,
A Constant Reader.

[Dr. Arnott in his Elements of Physics, Vol. II. part one, page 98, suggests a very ingenious, and we think practical way of obtaining fresh water from salt. Suppose any two air-tight vessels, of large size, communicating by a tube furnished with a stop-cock; then, if one of the vessels were filled with salt water, and were heated by being exposed to the sun, (its surface being blackened to absorb heat, and protected by glass from the cooling effect of the air), and if the other vessel were made a vacuum, by pumping out from its bottom the water with which it had been previously filled, and were then kept as cold as possible by wetted coverings and a current of air: on opening the stop-cock of the tube communicating with the two vessels, vapour would pass over from the warmer vessel to be condensed in the colder, and there would be a distillation from the sea-water by the natural action of the sun alone, of a water per-

Digitized by Google

fectly fresh and pure. Cases have occurred where a knowledge of this fact would have saved shipwrecked crews from perishing by thirst; and there are rocky islands in the ocean where there is no supply of fresh water, but from precarious rain or importation from abroad, but which might be rendered pleasantly habitable by the adoption of such a means.]

## MISCELLANIES.

*Red-coloured Sea.*—The conclusion of the short note on this subject, in Number 30, was accidentally omitted. Although the water taken up in a bucket as described, appeared quite transparent, yet a faint purple tinge was visible, when a few drops were placed upon a piece of white china, and moved rapidly backwards and forwards in the sunshine. A moderate magnifying glass proved that these little red dots, which with great attention could be perceived with the naked eye, consisted of *Infusoria*, which were of a spherical form, entirely destitute of all external organs of motion. Their very lively motions were only upward and downward, and always in spiral lines. The want of a powerful microscope precluded a more minute examination; and all attempts to preserve some of the animals by drying a drop of water on paper, failed, as they seemed to dissolve away. They were extremely sensible to the effect of nitric acid; for a single drop mixed in a glass of this animated water, put an end, almost instantaneously, to the life of millions that it contained. Poeppig, from whose travels this account is taken, says, that he sailed for four hours, at a mean rate of six English miles an hour, through this streak of coloured sea, which was seven miles broad, before he reached the end of it; and its superfices must therefore have been about 168 English miles square. If we add, that these animals may have been equally distributed in the upper stratum of the water, to the depth of six feet, we must confess that their numbers infinitely surpassed the conception of the human understanding.

*Thames Tunnel.*—At a late meeting of the Institute of Civil Engineers, Mr. Brunel gave an account of the Thames Tunnel. He explained the nature of the former operations of Vazie and Trevethick, by whom a tunnel five feet in height, two feet six inches in breadth at the top, and three feet at the bottom, had been carried more than 1000 feet. But in 1808, the river broke in upon it, and the work was irretrievably lost. It was from the data furnished by this operation, that his opinion of the practicability of the present undertaking was formed. The present excavation is thirty-eight feet in breadth, and twenty-two feet in height, and the support which is requisite for the ground, is furnished by the shield. The shield consists of twelve parallel frames ranged side by side, each frame being divided into three cells or partitions, by two floors. Mr. Brunel explained, by reference to drawings, the adjustment of the floors, the contrivances by which each frame was made to derive support from, or assist in supporting its neighbour, as necessity might require; and the manner in which it was advanced. Each frame stands on two legs, and advances, as it were, by short steps; having, for this purpose, an articulation very like that of the human body. The advantage of the system of building by rings, which he had adopted, had been fully demonstrated by the fact of the brickwork having sustained two eruptions, and yet exhibited no symtoms of rupture. The chasm formed at the last eruption absorbed more than 80,000 cubic feet of clay bags, before the workmen could re-enter the works. The greatest inconvenience under which they laboured, was the want of a drain: they had attempted to make one—but, getting into the stratum of quicksand fifty feet thick, which is at a small depth below them, were obliged to abandon the project. The land springs were a great source of annoyance; many of these were extremely offensive, and produced cutaneous eruptions, and were a great source of annoyance to the workmen. The difficulties of the work are vast, but there could be no doubt, but that in time they would be surmounted: the progress at the present point is necessarily exceedingly slow. The increase of the water informs them of what is going on above, and they guard against it accordingly. They had been much troubled by the unusually high tides of the present spring; the change from low to high water is exceedingly trying; in the natural ground it is usually attended with an increase of water, but in the ground made with clay bags, with a diminution. The works had advanced 127 feet since the introduction of the new shield. Some inquiries were made on the means adopted for ventilating the works, and considerable discussion took place on the methods of ventilation by rarefaction and condensation—that is, by drawing out or forcing in air. Mr. Brunel stated, that respiration and the pulse were slower in the diving bell, where condensed air

Digitized by Google

was breathed, than under other circumstances.

*Shoes and Gloves.*—M. Say estimates the number of shoes made in France at one hundred million, and the salaries of the workmen at three hundred million of francs every year. The value of leathern gloves manufactured in France, annually amounts to thirty million of francs. The establishments of this kind in Luneville alone, employ ten thousand workmen. England takes from France 1,500,000 pairs every year.

*The Tee-totalers.*—A gentleman of our acquaintance dining with a strenuous advocate of tee-totalism lately, in the course of conversation, observed, "You consider, then, do you, that I am to regard even a glass of ale as my enemy?" "Most certainly," was the reply. "Then," said the gentleman, deliberately taking his glass and bowing to his friend, "I am commanded to love my enemies," and with that drank its contents.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, June 14, Colonel Thompson, M. P., on National Economy.—Friday, 16, N. F. Zaba, esq., on the Literature of Poland, both at half-past eight.

*Aldersgate-street Institution*—Wednesday, June 14, T. King, esq., on the Nervous System of Man, at eight.

*Eastern Athenæum.*—Wednesday, June 14, C. Johnson, esq., Second Lecture on the History of Antiquities of Stepney, at eight.

*Poplar Institution*, East India Road.—Tuesday, June 13, Dr. Birkbeck, on the Measurement of Time, at eight.

*Society of Arts*, Adelphi.—Tuesday, June 13, H. Wilkinson, esq., on the Manufacture of Sword Blades, at eight.

*Eastern Literary and Scientific Institution*, 88, Hackney-road.—Tuesday, June 13, J. D. Holme, esq., on the Science of Phrenology, at eight.

*Mutual Instruction Society*, Great Tower-street.—Monday, June 12, Mr. Robinson, an Essay on Suicide, at eight.

*Kentish Town Mutual Instruction Society.*—Monday, June 12, Mr. Oakes, on Geography and Chronology as connected with History, at half-past eight.

*Mechanics' Institution*, New Road, near Gower Street.—Tuesday, June 13, Mr. Kisson, on the Production, Accumulation, and Distribution of Wealth, at eight.

*Finsbury Mutual Instruction Society.*—Tuesday, June 13, Mr. Dalton, on Chemistry, at half-past eight.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Red-Coloured Ivory.*—Sir, In consequence of several ineffectual attempts having been made to Dye Ivory an *Uniform Red Colour*, I should feel much obliged to any of your readers if they could inform me how it can be done; and if any, what mordant it would require? The insertion of this in an early number of your valuable little work will much oblige EBOR RUBRUM.

SIR,—When different earths are mixed together they become either hard, or soft, according to their nature; and having generally found blacking, and other bottles to approach the hardness of some stones, and to be even harder than many, I should be obliged if any of your correspondents can inform me of the nature of the composition of which these bottles are made, as I wish for something of the kind for the purpose of an invention.

I am Your obedient Servant,
TILES.

*Baking Provisions.*—A correspondent has written to us suggesting a plan by which he thinks a very important culinary operation, "baking," can be performed at home, over a common fire, as well as in the oven of a bakehouse. He proposes "a short iron oven, made like a saucepan, with an outside sheet of iron to keep the sides from getting cool." The heat and smoke should pass between the oven and its "case." For those who have not the convenience of a kitchen range with an oven, something of this kind, if manufactured cheaply, would no doubt be found exceedingly useful.

### ANSWERS TO QUERIES.

To "G. D. B."—*Royal Academy.*—None but students of the Royal Academy of Painting, &c., can become candidates for the medal offered in the different schools of that institution.

*Alarums* are to be obtained as low as 12s. each, at N. Vogt's, 26, Cleveland Street, Fitzroy Square, (German Clock Vender). They keep excellent time when regulated. I have one that has not altered a minute for the last six months. They will give the alarm at any time, which may be removed, or put on at pleasure, without impeding the clock's motion. P. H D.

## TO CORRESPONDENTS.

M. N.'s Improved Paddle Wheel, *we will find room for.*

*If* Mr. Cowell *will be kind enough to forward the drawing, it shall be inserted.*

C. C. W. *The drawings and descriptions of an* Improved Safety Lamp *and* Pin Drill, *shall appear the first opportunity.*

*The letters of* G. P. P; S. W.; *and* Thos. Mathews *on* Perpetual Motion, *shall be attended to.*

*The letter on* Railway Tunnels, *shall be inserted.*

*We cannot promise immediate insertion to the letter on* Lightning Conductors, *but it shall not be forgotten.*

*The drawing and description of* Payne's Floating Coffer Dam, *shall receive our early attention. Also the plan for rescuing persons from the Ice.*

*The paper on the* Fly Wheel *will most probably be inserted.*

A Birmingham Mechanic. *The work referred to may be obtained, at the reduced price of 8s. 6d. through the medium of our Printer, opposite* Palmer Terrace, Holloway Road.

*The letter on the* New School of Design, *shall appear next week.*

London: Printed at the Holloway Press, by D. A. DOUDNEY: published by BERGER, Holywell-street, Strand; and may be had of all Booksellers

Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXXIV.] SATURDAY, JUNE 17, 1837. Vol. I.

STEAM BOAT EXPLOSION.



Holloway Press: D. A. Doudney

Digitized by Google

## STEAM BOILER EXPLOSURE.

### ACCIDENT AT HULL.

CONSIDERING the immense number of steam vessels that are employed in this country for the purpose of voyaging, it will no doubt appear surprising to persons not well acquainted with the mechanism of the steam-engine, that accidents of any importance so seldom occur. It is a grand example of the intellectual power of man that he can regulate and control one of the most powerful forces yet discovered —that it can be made to minister to all his wants, and afford him pleasures far surpassing even many of those described in Eastern Fables. This giant power, however, sometimes shows its strength, tearing and destroying in its fury all the trammels by which its power had been confined, and producing a scene of devastation and misery that can only be imagined by those who have witnessed such occurrences. A frightful case of this kind has lately occurred. The Union, steamer, which plies between Hull and Gainsborough, on Wednesday morning, the seventh instant, was just on the point of starting from Hull, when on a sudden the boiler burst. The sides of the vessel were instantly torn asunder, fragments of the boiler and engine were scattered with a prodigious force, in all directions, and splinters of the deck, and portions of the luggage, with the mutilated remains of the unfortunate persons who happened to be on board at the time of the accident, were hurled into the water and on the shore, wounding those who happened to be near, and who had avoided being scalded by the steam as it escaped.

For the following additional particulars of the accident we are indebted to our excellent contemporary "The GUIDE," one of the cheapest and best newspapers published. The explosion took place at five minutes past six o'clock in the morning, and as the vessel was just on the point of starting, nearly all the passengers, as well as many of their friends, were on board. It is calculated that not less than sixty persons were in the fore and after cabins: most of whom were drowned. The report caused by the explosion was of the most frightful nature, and was heard at a most incredible distance from the place where the accident happened. The violence of the explosion may be imagined from the following circumstances. A porter, in the employ of the Dock Company, who was on board, was blown an immense height into the air, and fell on the top of a house three stories high. His mutilated remains rolled down the gable end of the roof to the spout, from whence he had to be taken down; of course he was dead. Mr. Chatterton, an extensive brewer of Hull, was sent with great violence across the jetty, against the yard arms of the Albatros steamer, which was lying on the other side of the pier, and he then fell on the gratings of that vessel. On being picked up he was found to be a corpse, his head being fractured in a dreadful manner. A great number of other persons which happened to be on deck were killed by being thrown with great violence to a considerable distance. A two-stone weight was thrown over the ends of the houses into Wellington-street, a distance of not less than seventy yards; several bags of flour, weighing twenty stones each, were forced into the air, a very great height; and a truss of goods, which had been blown up, fell with such violence into the slated roof of an adjoining house as to break it in.

The cause of the explosion has not been clearly ascertained, but one of the very few persons who escaped, a Mr. Taylor, states that from the sound produced by the passage of the steam through the safety-valve at the time he entered the vessel, he is convinced that there was not sufficient water in the boiler. We have no doubt on our own mind that this was the cause of the accident. An explosion of a boiler may proceed either from the steam within it obtaining a greater expansive force than the boiler will bear; or it may take place in consequence of the decomposition of the water, by which a highly explosive gas is generated, which is sufficient to produce all the effects we have just described.

An explosion from the first of these causes will not take place if proper attention is paid to the safety-valve. This valve is intended to prevent accidents of this kind. It opens outwards, and is kept pressed down by a weight, which is regulated according to the strength of the boiler, so that the force that is sufficient to raise the valve and allow the steam to escape, is much less than what would be required to burst the boiler; whenever, therefore, the steam acquires a certain pressure the valve opens and the steam blows off. All danger of explosion is thus prevented. It frequently happens, however, that the valve gets out of order; it may be loaded too heavily, when of course it is useless. It is customary to have a second safety valve in large boilers, particularly in those of steam-boats; and this valve is inclosed in a box, and locked up, in order to prevent persons meddling with it, and to prevent accident in case

Digitized by Google

the other valve should get out of order. Notwithstanding these precautions, however, accidents do occasionally take place, although they are seldom or never attended with such disasterous consequences as those that are produced from the cause we are about to describe.

Water is composed of oxygen and hydrogen gases, mixed together in a certain proportion, and when water is suddenly exposed to great heat it is decomposed into these gases: and if a light be then introduced into the mixture, it explodes with great noise and violence. It is this mixture of the gases that is used in producing the very brilliant light that is used for the oxyhydrogen microscope, with which most of our readers are no doubt familiar. Now, if a boiler is allowed to become nearly empty, the fire will cause those parts of it not covered by the water, and exposed to the action of the fire, to become red hot, and directly any motion of the vessel brings a portion of the water into contact with this red hot surface, the water either immediately flashes into steam, of immense power, or is decomposed, and the dangerous gaseous mixture we have described is formed, and explodes; the result is the destruction of the boiler, and every thing surrounding. Mr. Douglas, the inventor and patentee of a steam boiler intended to prevent these accidents, in his letter on the subject in our 32nd Number, page 250, says, "the formation of the explosive gases is the cause of all the explosions of steam-boilers, *and not steam*, as erroneously imagined." Mr. Douglas has had much experience on this subject, and is entitled therefore to be considered as an authority, and in the present instance, from the tremendous force with which the boiler burst, there can be no doubt that the accident was occasioned by the explosion of the mixed gases, produced by the decomposition of the water. We think great blame must attach to somebody. To have so little water in the boiler just before starting shows great negligence. It is necessary that a boiler should contain four or five times as much water as what is converted into steam every hour, and if this is not attended to there is constant danger of accident. It would perhaps be unfair to say any thing more at present respecting the conduct of the engineer, but we hope the accident will be the means of drawing the attention of the profession to the many proposed improvements in steam-boilers, some of which we are sure might be adopted with advantage. One of these improvements is described in Number 7, of the *Penny Mechanic*, to which we beg to refer our readers.

## THE STEAM ENGINE.

NO. IX.

In physical science discovery has always been progressive. We have instances, it is true, in which this appears not to have been the case—where the most trifling circumstance has been sufficient to excite in the mind of a philosopher a train of thought that led him onwards to discoveries the most brilliant and unexpected that could be imagined. The well-known manner in which it is said Newton was first led to a perfect understanding of the principle of gravity, might be adduced as an example: but though the falling of an apple might be the immediate cause of the wonderful discovery that will immortalize his name for ever, yet, had it not been for the laborious exertions of preceding philosophers, who had carefully noted down and accumulated a vast number of facts, which it only required the theory of Newton to explain, he never could have made the discovery he did. If we search the annals of every science, we shall find in all, that before any grand discovery of an unknown law took place —before any phenomena the cause of which was unknown, was clearly explained—that a number of facts had been accumulated—a number of observations had been made, and *then* the master mind arose, some surpassing intellect who perceived the connecting links of the chain by which these apparently isolated facts were connected together, and who grasping in his capacious mind the *rationale* of the whole, propounded the laws to which they were all subject, and which they all obeyed.

In the History of the Steam-engine we have an illustration of these remarks. We have seen how gradually the stock of knowledge relating to the wondrous machine was accumulated; how gradually the engine was improved; and how on a sudden the genius of Watt burst forth, and converted what had previously been little more than a philosophical toy, into one of the mightiest agents for human improvement that has ever been employed. In his mind's eye Watt perceived even more than the poet ever did. His imagination acting on the materials that had been provided by those who had preceded him, enabled him to design and execute the various improvements in the old steam machinery which really *made* the steam-engine, and to obtain for himself a name more glorious than has ever yet been gained by warrior or by statesman, and that will endure as long as mankind shall remember their greatest benefactors, or appreciate that civilization which the steam-

Digitized by Google

engine has done so much to diffuse, and will be the chief means of extending and preserving.

The great fault of the atmospheric-engine, described in our last paper on this subject, was that it required an enormous quantity of fuel in order to keep it in proper action. This will perhaps be best understood by referring to the common glass atmospheric apparatus. The principal on which it acts is the same as that of the atmospheric-engine. The water in which is converted into steam by the heat of the spirit-lamp, and accordingly drives up the piston rod. Before this can take place, however, it is necessary that the cylinder itself should be raised to the same temperature as the steam, otherwise it would condense the steam into water. When we remove our finger from the top of the piston, and allow the steam to escape, as the piston-rod in this instrument is made hollow, the pressure of the atmosphere drives the rod down, and at the same time cools the cylinder. In the atmospheric-engine the descent of the piston was accomplished by injecting a quantity of water into the cylinder, by which means the steam was condensed. As water when relieved from the pressure of the atmosphere will boil at a temperature considerably below the ordinary boiling point of 212°; it was soon found that the condensing jet was not sufficient to prevent the formation of a vapour that impeded the descent of the piston; and accordingly a sufficient quantity of cold water was obliged to be introduced in order to cool the cylinder and condense the steam below 100°. The waste of fuel from these causes will at once be understood. A great quantity of steam was wasted in heating the cylinder before an effective stroke could be obtained, and then the cylinder was obliged to be cooled so much that the process of heating it had to be effected every time the piston was raised.

In 1763, Watt, who was a mathematical instrument maker to the University of Glasgow, received a model from the Natural Philosophy class, of an atmospheric steam-engine that they required to be repaired. He had previously had his attention directed to the steam-engine by Dr. Robison, but experienced so many difficulties in attempting to improve it, that he had neglected it for other more important occupations. Now, however, that he had the opportunity of experimenting upon an atmospheric-engine, he did not fail to do so, and being wiser from his previous unsuccessful attempts, he conducted his experiment with more skill. The first circumstance that attracted his attention was the one just noticed; the great waste of steam in working the engine. This he attempted to remedy by constructing the cylinder of materials that were bad conductors of heat, such as hard baked wood soaked in oil, &c. He soon, however, perceived, on considering the structure of the engine, and the circumstances under which it worked, as we have just described them, that it could not be made to act efficiently without a very great waste of steam. After reflecting on the matter attentively, it occurred to Watt that this inconvenience might be remedied if the steam were condensed in some other vessel than the cylinder. In this case the *cylinder* might always be maintained at a temperature that would not condense the steam, while the *condenser* itself could be kept cool, and thus effect the object required without its being necessary to make any change in the temperature of the cylinder. For this purpose Watt proposed to provide the engine with a separate vessel, to which an air pump should be attached, so that a vacuum might be produced in it. This condensing vessel was to be connected with the cylinder by a pipe supplied with a stop-cock, and whenever this cock was opened, of course the steam would rush out of the cylinder to fill the vacuum in the condensing vessel. This vessel was kept at a low temperature, being surrounded with cold water; and a jet of cold water was also forced into it every time the steam was admitted. By these means the steam was immediately condensed, and thus one grand improvement in the working of the engine was accomplished. Watt states that directly the idea of condensing the steam in a separate vessel occurred to him, the other details suggested themselves so quickly that he was enabled at once to submit his speculations to the test of experiment. A second improvement was made almost simultaneously with the first. As the steam was condensed of course water accumulated in the condenser; and a quantity of air entering along with the condensing jet, prevented in some measure the descent of the piston; it was necessary therefore to have some mode of removing both the water and the air as fast as it accumulated. To effect this, Watt added an air pump to the engine,—it was fitted to the condenser, and the piston of the pump being made to rise and fall by the motion of the beam, a very good vacuum was constantly kept within the condenser, which by means of the cold water surrounding it, condensed the steam directly it entered, and an immense saving of fuel was thus effected.

Digitized by Google

## FIRE ESCAPES.

*To the Editor of the* PENNY MECHANIC.

SIR,—The establishment of the society for the preservation of life from fire, I consider must have proceeded from the best of motives, and its exertions are most laudable; what I am going to write is therefore with the most friendly intention. The institution like most societies at their commencement, must have so much to learn, as well as teach, that I make so bold as to throw out some hints on that subject. One of its objects is to call forth the ingenuity of persons to invent machines for the purpose. Should not the society by every possible means encourage persons to bring forward their contrivances, and try them in comparison with what the society possesses? Should they not appoint one person in particular, as the maker of their machines who sympathised with the institution, and who would receive such notices as occurred to persons on the subject? Should they not make regular reports as to the merits or defects of the contrivances, how far they are superior, or if superior at all, to a common ladder? Otherwise they may place reliance on machines, rather because they are ingenious, than applicable. Should they not have a place of deposit for all models? Should they not have a quarterly lecture on the subject, and require a certain number of the police from each district of the city to attend them? One of the desiderata in these matters seems to be that the contrivances should be moveable with facility, as a few minutes sometimes are of consequence. The most simple contrivance known which may be carried by one man, is a rope and a pole, so put it up to a person's window from the street. It may be said a woman would not think of coming down by such means; that may possibly be the case, but that is no reason why such an apparatus should not be at hand, for there are men that would avail themselves of such means, and possibly some women, as I have an account of a woman who saved her life by coming down by aid of the water-pipe. Another contrivance I consider very simple and easily carried to be put up to a window by means of a pole, and so tie a long canvas bag, such as you see made use of for carrying a circulation of air in the holds of ships. To make it strong enough, there must be run in the canvas, lengthwise, strong cord, or twine. Now it appears to me if such a canvas tube, (if I may use the expression) were fastened to a bedstead in a three-story room, a person in letting himself down in it, would have this advantage over a rope, that the canvas could not slip through his hands, and his feet and knees would have hold of the canvas to regulate his descent; besides if persons held the bottom of the canvas from the ground, a dog might be thrown down without danger, as an experiment.

C. W.

## A FIRE-PROOF DRESS.

A Signor Sebastiano Botturi, from Brescia, in Italy, on Thursday exhibited a fire-proof dress, in which he enveloped himself, and passed through a small cottage or shed, erected for the occasion, in the grounds of Cremorne-house, and set on fire for the purpose of proving the incombustibility of his invention. The shed was constructed of thin wood and spars, and crammed with straw and dry chips. The experiment was advertised to take place at half-past three, but it was half-past five before the shed could be prevailed upon to blaze with sufficient fury for the proof of his salamander-like qualifications. The Signor, when clothed in his fire-proof habiliments, bore some resemblance to a Polar bear on its hind legs; his head was covered with a curious kind of gear, something like a conical cap; it had two glass eyes, or rather windows, which glared without speculation on the company. There was also a snout or chimney for the purpose of respiration. This last apparatus made the whole a most grotesque exhibition. The dress was plastered with a sort of compound resembling a mixture of grease and mortar, but, as this is the secret of the contrivance, it is impossible to describe what it really was. As soon as the flames had sufficiently seized on the shed, the Signor boldly entered at one end, and made his exit at another, repeating this feat several times without injury.—*Times.*

## SCIENTIFIC JOURNALS.

*The London and Edinburgh Philosophical Magazine for June* 1837.

THE greater portion of the present Number is occupied with papers on subjects connected with Galvinism and Electricity. One by Dr. Andrews "on the thermo-electric currents developed between metals and fused salts," contains an account of some very interesting experiments that have been made by the writer, in illustration of the subject. A paper by Mr. A. Essex, on the art of painting in enamel will also be found to deserve an attentive

Digitized by Google

perusal: the whole process is well described. The writer remarks that the power of resisting decay, renders enamel a valuable medium for conveying down the stream of time the likenesses of celebrated individuals. Some rude specimens of vitrified colours have been found in Egypt, which have existed between two and three thousand years, but which still appears as fresh as if they were but the production of yesterday. Portraits, whether executed in oil or in water colours, change in a comparatively short period, the rosy tint, becoming pale, and the high tint, sallow; and where the delicate transparent tints shed their deepening beauty, opacity gradually supervenes. But those which are fixed in enamel will carry on unchanged, to a period indefinitely remote, the most delicate as well as the richest tints originally imported by the artists; and as he left the portrait of the sage, the poet, the warrior, and the beauty, so will they remain, when even the marble which pourtrayed their forms, or told their history, may have crumbled into dust. The botanist will find two short articles of much interest; one "on the supposed absorbent powers of the cellular points or spongioles, of the roots of trees, and plants;" and the other on "the rise of the sap." M. Dutrochet, if we mistake not, first gave weight to the opinion that the nutriment which trees and plants derive from the soil in which they grow, is taken up exclusively by the cellular extremities of their roots, which from their texture have been called spongioles. The theory of Endosmose and Exosmose, or the supposed explanation of the peculiar circumstances connected with the absorbent power of organized membranes, depend in a great measure for support on the imagined absorbent power of these spongioles; but in the paper before us, Mr. Knight denies that they do absorb, and says that from a great variety of experiments he is led to believe it is through the albumham alone that the ascending sap passes, and as spongioles do not contain albunious fibre, they exercise no influence whatever. There are several articles of information connected with chemical science in the present Number, but we have not space to notice them at length.

---

*The Repertory of Patent Inventions.*

This excellent work maintains the high reputation it has deservedly acquired as a journal of scientific information. The present Number contains specifications, well illustrated, of seven patents, besides much useful intelligence. The first patent described is that granted to Mr. John Pickergill, for an improved method of applying Indian-rubber to fabrics. According to the ordinary method of making water and air-proof fabrics by the aid of Indian-rubber, whether laid in a thin layer or coating, on one side of a fabric, or a surface of Indian-rubber, between two thicknesses of fabric, the same has been performed by dissolving Indian-rubber, by means of naptha, or other chemical solvents, which bringing the Indian-rubber into a fluid state, it is spread over the fabric to be rendered waterproof; and when the same is intended to be a layer of Indian-rubber, between the two surfaces of fabric, the fabrics being covered by a brush or similar means, with the dissolved Indian-rubber are stuck together by pressure. The object of the invention is the preparing Indian-rubber by rolling it into thin sheets, and applying them to the surfaces of fabrics, that the same may be rendered air and water-proof without the aid of solvents. The inventor also proposes to apply colouring matter to the Indian-rubber, by which it will not only be coloured, but its sticking properties also be prevented, and the Indian-rubber may then be used without any covering or lining. The above invention if found to answer will probably supersede in a great measure Macintoch's patent cloth. There is also a description of Messrs. Scott and Oliver's patent for an improvement in the manufacture of hats and bonnets. It consists in the formation of a contracting and expanding frame formed of wire or whalebone, which is attached to the inside of the hat, and is so constructed as to permit the crown to be compressed or folded down towards the brim, and of being again expanded to the original hat or bonnet shape when required. The expanding and contracting frames consist of two rings, one of which is sewed to the crown of the hat, and the other, which is of an oval form adapted to the head of the wearer, is sewed to the lower part or brim. Four or more uprights are affixed to these rings by joints, and they have also joints near the middle, which permit the uprights to fold inside the rings. A ring or circle of metal having slight curvatures in it, corresponding with the upright, is sewed into the lining of the hat, forming a moveable crown by which the hat is retained in the proper shape or compressed at pleasure. In the present Number there are also the specifications of Mr. Clay, for an improvement in manufacturing sulphate of soda, by condensing the muriatic acid, disengaged by the de-

Digitized by Google

composition of salt with sulphuric acid, in open or reverberatory furnaces—also of Mr. Buchanan's for an improved apparatus for dying—Mr. Ruthven's for a new method of forming rails for railways; and of Mr. Parke's for improvements in flat pit chains.

*Louden's Magazine of Natural History.*

The articles in the present Number will be more interesting to the naturalist than the general reader. In a paper "on the existence of electrical currents in vegetable structure," the writer adduces a number of facts to show that electrical currents are developed during germination, and that their influence is necessary to the proper performance of that process. An article on the preservation of botanical specimens from the attacks of insects will interest the botanist. The author from experience considers that washing the specimens with a solution of corrosive sublimate is the best preventive.

## MISCELLANIES.

*Steam Engine Crank.*—A correspondent "T. M." in the course of a letter on Perpetual Motion, which we cannot spare room to insert, makes the following observations on the crank.—Among the many improvements which has been introduced into the steam-engine of late years, no inventor has ever made any effectual improvement in the crank, which communicates motion to machinery. It is well known that land-engines require a ponderous fly-wheel to carry the crank past the "dead centres," and so continue the revolving motion. I will brave that species of ridicule which "Z. W." complains of in order to elicit information, by asserting that the full power of a single engine upon the crank does not exceed one-third of its revolution. And that the power of double engines with two cranks at right angles; to such as propel steam vessels, does not exceed two-thirds of the revolution. I have been induced to offer the above observations in consequence of the friendly invitation you give to working mechanics to try their pen and brains in these discussions; notwithstanding their untutored, or "unrefined style of composition," and beg to conclude by putting the following question. If a steam vessel with two engines of fifty-horse power each, will go at the rate of fifteen miles an hour, with the cranks as at present in use, what power of (single) engine would it require to drive the same vessel, at the same rate, providing the full power of the engine could be brought to bare with equal force upon every part of the revolution of the crank?

## INSTITUTIONS.

*London Mechanics' Institution.*—The usual quarterly meeting of the members of this Institution took place on Wednesday evening. Dr. Clutterbuck, V. P., in the chair. After the minutes of the last quarterly meeting had been read, a discussion ensued before they were allowed to be confirmed, in consequence of some remarks that were made by a little gentleman, with a very shrill voice, and who appeared to be rather at a loss occasionally what to say. It was difficult to catch the purport of his observations, in consequence of the coughing, laughter, and hisses with which they were received; but it seemed that he made a charge against a gentleman on the platform, whose answer to it was received with much cheering. The sharp speech of the little gentleman did not appear to have its intended effect of making Mr. Guthrie angry. After the minutes had been confirmed the Committee presented their report, by which it appeared that during the past quarter 296 new members had joined the Institution, and that the present number was 1243. The expenditure during the quarter had amounted to 440l. 12s. 6d., and there was 199l. 2s. owing by the Institution. The expenses of the quarter were 460l. 1s. 8d. The receipts of the quarter had been 436l. 17s. 2d. The balance in the hands of the bankers at the commencement was 109l. 7s. 1d. There was therefore a balance in the hands of the bankers at the present time of 105l. 11s. 9d., and 10l. in the hands of the Secretary. We are sorry to perceive that of the number of members who subscribe to this Institution, there are only *four* ladies. The number of single lecture tickets sold amounted to 94. After the Report had been received, a proposition was brought before the meeting, of which the object was to prevent members under eighteen years of age taking part in the government of the Institution. This measure, it was stated, was almost forced upon those who brought it forward, in consequence of the very indecorous manner in which the younger members had lately conducted themselves. The subject has frequently been a cause of complaint by the older members, and has lately attracted the attention of all who wish the Institution to prosper. In the "London

Digitized by Google

Magazine," a Journal of Educational Institutions, for the last month, we were sorry to perceive the following paragraph:—"There are a great many little boys who subscribe to this Institution, and do not know how to behave themselves properly. Before and after the lecture, and frequently during its delivery, they annoy the other portion of the audience by making a very unbecoming noise; and we are sure that a stranger attending a lecture, and witnessing this conduct, would form a very unfavourable idea of the Institution. We hope the Committee will be able to put an end to the nuisance." A book has been opened by order of the Committee, in which workmen out of place can register their names; and masters will thus have the opportunity of procuring assistants without trouble. Every young mechanic in London who can afford to spend six shillings a quarter for his education, ought to subscribe to this excellent Institution. The Meeting is adjourned till the 26th July.—*(From a Correspondent.)*

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, June 21, Colonel Thompson, M. P., on Free Trade.—Friday, 23, N, F. Zaba, esq., on the Literature of Poland, both at half-past eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, June 22, N. F. Zaba, esq., on the Literature of Poland, at half-past eight.

*Aldersgate-street Institution*—Wednesday, June 21, T. King, esq., on the Nervous System of Man, at eight.

*Poplar Institution*, East India Road.—Tuesday, June 20, C. R. Pemberton, esq., V. P. of the Institution, on the Philosophy of Shakspeare, at eight.

*Mechanics' Institution*, New Road, near Gower Street.—Tuesday, June 20, Mr. J. F. Holdenesse, jun., on the Fundamental Principle of Phrenology, at eight.

*Finsbury Mutual Instruction Society.*—Tuesday, June 20, Mr. Collis, on the Atmosphere, at half-past eight.

### ANSWERS TO QUERIES.

*Receipt for Colouring Ivory.*—To cause the ivory to imbibe the colouring matter it should be boiled in clear water, containing equal portions of nitre and sulphate of iron; whilst hot it should be immersed in the following dye:—Soak powdered fernambuc (Brazil wood) in alcohol, and when the liquid has acquired a sufficient intensity of colour, immerse the ivory; the dye will penetrate considerably in a very short time. Or, by another method,—Boil, in common water, the shearing of scarlet cloth; when it begins to boil throw in a little pearl-ash, which will disengage the colour from the wool, and tinge the water a deep red; you then add a little alum, and strain the mixture to free it from the wool. Before dipping the ivory in this mixture it will be necessary to plunge it (for a moment only) in nitric acid, weakened with water.

P. H. D.

ADVERTISENT.—LONDON MECHANICS' INSTITUTION.—LECTURES.

Mr. T. Phillips, on Vocal Music in Dramatic Effects, with Select Scenes, assisted by the Misses Brandon; June 9.

Colonel P. Thompson, M. P., on National Economy, Free Trade, the Corn Laws, and Currency; June 14, 21, 28, and July 5.

J. Pereira, Esq., on Vision, Physical History of Light considered in relation to Physiology, &c., June 30; and on Hearing, Nature and Qualities of Sound, July 7.

Basil Montagu, Esq., on the "Patriot and Demagogue," July 12.

Basil Montagu, Esq. on Government, July 19.

Professor Calvert, on Elocution, and the Art of Reading, July 14, 21, 28, and August 4.

Mr. Ogilvie, on the Nature and Properties of Water. July 26.

T. Webster, Esq., on Geology, August 2, 9, 16, and 23.

J. Hemming, Esq., on Chemistry, August 11, 18, and 25.

Dr. Birkbeck, on the Muscles and Muscular Motion, August 30.

Subscription twenty-four shillings yearly, or six shillings quarterly, with 2s. 6d. entrance. Tickets for the evening, one shilling each.

A Prospectus, giving full particulars, may be obtained at the Institution.

ANDREW M'FARLANE, Secretary.

No. 29, Southampton-buildings,
Chancery-lane, June 7, 1837.

### TO CORRESPONDENTS.

S. W. *will perceive what we have said in the present Number respecting Explosions of Steam Boilers. We shall be glad to hear of his proposed "remedy."*

C. M.'s *suggestion shall not be forgotten. His paper must stand over for a short time, till we come to a determination on the subject.*

China *and* A Constant Reader. *The two last pages of Number 32, containing the Advertisements, can be cut off when the work is bound up: they were inserted* as Advertisements, *not as a part of the Magazine*

*The nearest approach to Perpetual Motion, by* Brack himself, *shall appear.*

Mr. Greeley's *drawing and description of* an Alarum, *shall appear in an early Number*

*We have not been able yet to give proper attention to the communication of* M. N. *on* an Improved Paddle Wheel.—C. H. S. on Aerostation—*and* F. V. E. on Cheap Electrical Apparatus. *We will do so by next Week.*

*The letter referred to by* M. J. a Frenchman and Constant Reader *will be very acceptable The translation will save trouble, but if in the original it will be no objection.*

Mr. Cowell's *Letter and Drawing shall be inserted very probably next week."*

*Accepted* P. H. D.—D. J.—W. B. Haynes.—J. Johnson.—*and* A. W.

*Received* Brack's Brother.—Query for N. N.—*And* Mechanicus.

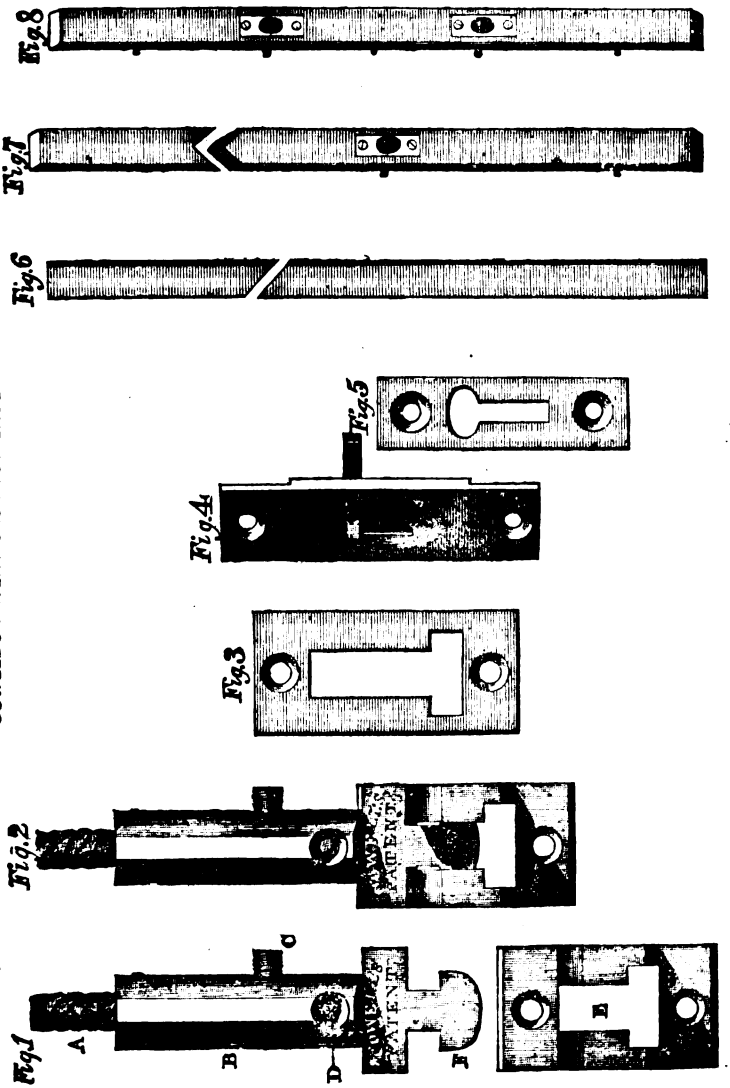
London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXXV.] SATURDAY, JUNE 24, 1837. [Vol. I.



Vol. I.—No. XXXV. Holloway Press: D. A. Doudney



Digitized by Google

## COWELL'S PATENT SASH SUSPENDERS.

*To the Editor of the Penny Mechanic.*

SIR,—In your Number 26, you were pleased to publish a letter I addressed to you on the subject of my "Patent Sash Suspender," an invention for preventing accidents from window cleaning. I now send you a drawing of the same with description, and full particulars for fixing, that your readers—as other plans are proposed—may be able by comparison to judge as to the best method of effecting so desirable an object. The expense of mine being but a few pence (viz. in iron only four-pence half-penny each) will I think convince the most captious that their ingenuity can only be profitably exercised by an attempt to discover a more perfect instead of a *make-shift sort of plan*. It will at once be seen that the principle I have adopted is of the most simple description—there is no part of it that can possibly get out of order, nor be easily broken or lost, as might be the case with a dovetail wedge, suggested by your correspondent Mr. Morton, to replace which would require a carpenter, and consequently incur an expense equal to a set of my suspenders for a pair of sashes. Confident that this and other objections to the plan alluded to have not escaped your observation,

I remain Your obliged
And Obedient Servant,
H. B. COWELL.

### DESCRIPTION OF ENGRAVING.

Fig. 1, A the sash line, B the socket that receives the sash line, C the screw that presses the spring within to secure the line, D an aperture to show that the line is at the bottom of the socket, E a plate, or eye, to be let into the sash to receive the hook F. Fig. 2, shows the hook F and plate E attached. Fig. 3, a plate to be let into the sash frame, at a convenient height, to receive the hook F fig. 1, when shifted from the sash, to prevent its running up to the pully out of reach. Fig. 4, a flush bolt to be let into the bead to fix it instead of nailing. Fig. 5, a plate to be let into the sash frame for the bolt to lock into. Fig. 6, the parting bead. Fig. 7 and 8, the 5-8ths, or outside bead.

### DIRECTIONS FOR FIXING.

Insert the end of the sash line into socket B fig. 1, when seen at D, turn the screw C. Sink plate E into the end of the sash, above where the line is usually nailed, and mortice sufficiently to admit the whole fig. 2, to lay flush; the top of socket B may come within one inch of the Pully. Let a plate (fig. 3,) into each side of the sash frame to receive the kook F, (fig. 1) when shifted from the sash; one plate is made to accommodate two suspenders, holding them both within reach until they are again wanted; they may be placed about eight inches above the meeting rails of the sashes. Cut parting bead, as shown, fig. 6, so that two-thirds take out and in, fixing in its place the top piece with brads. Cut five-eights or outer bead as shown, fig. 7, fixing the upper portion; three-fourths of this bead (say the one on the left hand) must be moveable; one dowell about nine inches from the bottom, and one bolt fig. 4 a little above the centre, will fix it as firmly as nailing; if the whole of the bead be made to shift, three dowells and two bolts must be employed as seen in fig. 8; this mode is preferable for parlours and drawing-rooms as no joint is then seen.

[We have before alluded to Mr. Cowell's very useful and ingenious invention; but now that our readers have the opportunity of judging whether it deserves the praise we bestowed upon it, we cannot forbear remarking that those who think so should do what lies in their power to make the invention publicly known. The price charged for the "sash suspenders" is so exceedingly low, that the patentee can never be remunerated for his trouble unless they are generally adopted, which, however, we have no doubt will be the case, as they are so very simple in their construction, and calculated to effect so much good.—ED. P. M.]

## UNFORTUNATE INVENTORS.

THE readers of the PENNY MECHANIC must frequently have heard of unfortunate speculators, who, after devoting years of toil and study, and spending large sums of money in order to bring some favorite scheme to perfection, are at last obliged to endure the bitter disappointment of having all their exertions neglected, or treated with contempt. We have no doubt our readers must occasionally have heard of these unfortunate speculators, but they can hardly form an idea how numerous such persons are. We are often meeting with them, and have observed with pain that the more unlikely any particular invention is of becoming generally useful, and the more hopeless the chance of success, that just in that proportion does the inventor overrate the importance of his project, and devote time and money in abundance in order to bring it to perfection. In some of our back Numbers we

Digitized by Google

have inserted communications from the writer of the following letter, that illustrate, to a great extent, the remarks just made. It is true that the subject on which he writes is one of much importance; but how melancholy it is to reflect that so much valuable time should have been devoted to one object, when it might have been employed successfully on so many others. We insert Mr. Rough's letter because it is one instance of many that we are acquainted with, where talent, time, and money, have been employed for the public benefit without reward; and also because we hope the letter may draw the attention of some of our readers to the unfortunate condition of the writer, and perhaps be the means of realizing some of his plans.—Ed. P. M.

---

### SHIPWRECKS, &c.

*To the Editor of the Penny Mechanic.*

Sir,—Since I sent you my last "on Saving Property by Fire;" and "on Preventing Explosions by Gunpowder," which you obligingly published in the 21st Number of your Penny Mechanic, I have been afflicted with inflammation in the left eye, (of which I have been totally blind forty-five years:) and during five weeks, I could scarcely see with the right. But, even on the bed of death, my wish will be to prevent loss of life and property by fire and shipwreck. I have invented and will send you a description of a boat, which if it strike on a rock, sand-bank, or sunken pile, can be unladen without purchases, and the whole of the crew, passengers, and cargo, saved and safely brought into port. If the boat, or any part of it should fill, without pump it can be instantly cleared. It can be strengthened almost equal to the strength of a solid mass of timber, and it can contain provisions for its crew for six months. It can also contain apparatus for making salt water into fresh; with means of taking fresh fish in abundance: also, apparatus for saving sixty hands at once from a wreck, with wine, and restoratives for the sick and wounded. It will require little or no ballast; if any should be wanted, the kelsen will answer for that purpose. It will demonstrate the practicability of strengthening all merchant ships: and, perhaps men of war, by forming the water casks, provision casks, bales of merchandise, and all the officers, passengers, seamen, and soldiers' baggage, into perfect seagoing boats, or into perfect segments of seagoing boats, by which boats, or segments of boats, the cargoes and crews of most wrecked ships can be saved, and brought without injury to the end of their voyage. When going before the wind, she can be regulated to prevent deep rolling, and, consequently carry more canvas, in proportion to the size of her hull, than any boat now in use.

The danger to which the crews of life-boats, are now, in my opinion unnecessarily exposed, when launching their boats on a lee shore in a heavy gale, will thus, be diminished and perhaps entirely removed, by assistant boats, being always either under weigh, or at anchor to windward. I believe the loss of seamens' lives in endeavouring to get to windward to assist vessels in distress, has never yet been noticed, but by the record of the separate losses, as they occurred! and no writer has yet to my knowledge, called public attention to the practicability of always assisting boats to windward.

To the rich and powerful, the immediate advancement of such a universal object of benevolence, would be an imperishable monument of well-earned fame! To the sordid and avaricious, it would yield a firm foundation, whereon they could raise the structure of future wealth, without risque; and to the British nation it would be an act of justice, that would save the lives of her valiant seamen, whose numerous deaths, have recently filled the cottages of her widows and orphans with famine, and unavailing, unceasing lamentations.

From the liberality of the gentlemen connected with the press, I am led to suppose, that all would cordially unite in the accomplishment of this humane design: and that the obstacles that impeded me, since the seige of New Orleans, would be removed. My physical strength is daily failing, and I know, that my mental energies will soon decay. If I do not bring my works to perfection in a year or two, they will be lost to society for ever: and my last stage will be embittered, not only by want; but, with the consciousness, that I laboured unavailingly all my life, to save life and property from fire and shipwreck. I have done every thing a person situated as I am could do with the pen: but, unaided by the press, it is a feeble instrument: united, however, in the cause of suffering humanity, the strongest prejudices would break down, as snow melts before the sun, and I should feel recompensed for the thirty-six years of study, and the £720 I have expended on the subject. Though late, the 36,000 letters I wrote in fourteen years in London, would be recalled to memory; and a benevolent and enlightened nation,

Digitized by Google

would encourage me to persevere in perfecting my plans for saving life and property from fire, shipwreck, and inundations, all of which, (my published plans) I am capable of revising and improving.

Yours most respectfully,

MICHAEL ROUGH.

21, *Little Earl-street, Seven Dials.*

## RAILWAY TUNNELS.

*To the Editor of the Penny Mechanic.*

SIR,—Should you deem the following few lines worthy of a place in your little, but really valuable Magazine, they are at your service.

On March the 24th last, which was Good Friday, I was induced to take a stroll, and by mere accident directed my steps to the Birmingham Railroad, down which I walked for a considerable distance, till I arrived at the Tunnel, under the Harrow Road, near the Cemetry at Kensel Green; and feeling very desirous of entering it, after some little cavelling with the guard or keeper, I was at last admitted. That day, it may probably be in the memories of the majority of your numerous readers, was excessively cold, being a frost, with occasional sleet, &c. When I entered the tunnel, which was in a very rough and unfinished state, I was somewhat surprised to find it exceedingly damp, and I thought much colder than the surrounding external atmosphere, which of course was the result of an over-abundant supply of humidity, and the total absence of any possible effect from the sun or other external causes to disperse it. On entering further into the tunnel, I was much surprised at the apparent carelessness of the turning of the arch; and I was not alone in my opinion, for many persons who were in the tunnel at the same time, expressed their sentiments similarly. Every change or shift of the centreing was distinctly visible, some being considerably higher and some lower than the rest; and in many places bricks actually projected two or three inches down into the tunnel, as if endeavouring to escape from the crushing of the rest. In fact, as I saw it, it was not at all calculated to inspire any idea of safety, but quite otherwise, and which was further heightened by the projection of the mortar from every crevice, from the action of the frost on the mortar in an excessively humid state which necessarily swells it, and every time the engine passed through shook it down from the crown and sides in showers. I do not say that the tunnel is not safe, but think that the proprietors do not act rightly to themselves by admitting strangers into it in such a state; particularly at this time, when so many accidents have happened at Watford and other tunnels in the course of erection, which may materially tend to increase the aversion of the public generally to travelling through tunnels. They ought not to have been admitted at least till it was cemented over—for I am certain that the tunnel must be cemented over to cover the roughness, as well as to prevent the copious percolation of humidity through the walls—for the bricks are very *porous*, not being of very good quality. On the whole the tunnel may be perfectly safe; but it should be cemented to insure confidence.

The dampness was excessive, the walls in many places actually dripping, and in no small quantity, and the greater part was covered with a good thick coat of hoar frost, and huge clusters of isicles hung from the roof like stalactites, which had a rather curious effect. I also observed one or two plates of iron inserted in the walls for some purpose, completely oxydated—and, judging by present appearances, not long to be relied upon for safety—they were very rapidly decomposing. Great quantities of rain had fallen for some time previous to my visit, and therefore the ground in the vicinity of the tunnel was in, I should say, a maximum state of humidity, so that the average would be much less than when I saw it. If the interior of the tunnel were properly cemented it would prevent all, or nearly all percolation, and consequently prevent dampness; beside adding to the appearance of the tunnel.

The length of the tunnel is inconsiderable, and not very deep under ground, which excited my surprise the more.

I am, Sir,

Yours truly,

JACK'S BROTHER.

[We are of opinion there is not so much danger to be apprehended from the workmanship of the tunnel as Jack's Brother would induce many timid persons to believe. Turning an arch under ground, is not to be performed with the exactness it is done on the surface, where men have day-light and the full use of their limbs. However, it does not follow that none but architects and engineers are capable of discovering errors or danger. Mr. Hunt, the late Member for Preston, discovered the settling of the arches of New London Bridge, which occasioned so much alarm at that time for its safety: and most likely our Correspondent's letter will be read by the gentleman under whose direction the

Digitized by Google

tunnel was constructed; when, no doubt, should he conceive his character at all affected by it, he will communicate with us; and, we shall feel happy in laying his statement before the public.—Ed. P. M.]

## LIGHT AND VISION.

NO. II.

The explanation which our knowledge of optical law, affords of the mechanism of the eye, and the process by which vision is performed, is as complete and satisfactory as that of hearing by the propagation of motion through the air. The camera obscura, invented by Baptista Porta in 1560, gave the first idea how the actual images of external objects might be conveyed into the eye, but it was not till after a considerable interval that Kepler, the immortal discoverer of those great laws which regulate the periods and motions of the planets, pointed out distinctly the offices performed by the several parts of the eye in the act of vision. From this to the invention of the telescope and microscope there would seem but a small step, but it is to accident rather than design that it is due; and its re-invention by Galileo, on a mere description of its effects, may serve, among a thousand similar instances, to show that inestimable practical applications lie open to us, if we can only once bring ourselves to conceive their possibility, a lesson which the invention of the achromatic telescope itself, as we have before related it, not less strongly exemplifies. The little instrument with which Galileo's splendid discoveries were made was hardly superior in power to an ordinary finder of the present day; but it was rapidly improved on, and in the hands of Huyghens attained to gigantic dimensions and very great power. It was to obviate the necessity of the enormous length required for these telescopes, and yet secure the same power, that Gregory and Newton devised the reflecting telescope, which has since become a much more powerful instrument than its original inventor probably ever contemplated. The telescope, as it exists at present, with the improvements in its structure and execution which modern artists have effected, must assuredly be ranked among the highest and most refined productions of human art; that in which man has been able to approximate more closely to the workmanship of nature, and which has conferred upon him, if not another sense, at least an exaltation of one already possessed by him that merits almost to be regarded as a new one. Nor does it appear yet to have reached its ultimate perfection, to which indeed it is difficult to assign any bounds, when we take into consideration the wonderful progress which workmanship of every kind is making, and the delicacy, far superior to that of former times, with which materials may now be wrought, as well as the ingenious inventions and combinations which every year is bringing forth for accomplishing the same ends by means hitherto unattempted. After a long torpor, the knowledge of the properties of light began to make fresh progress about the end of the last century, advancing with an accelerated rapidity, which has continued unabated to the present time. The example was set by our late admirable and lamented countryman, Dr. Wollaston, who re-examined and verified the laws of double refraction in Iceland spar announced by Huyghens. Attention being thus drawn to the subject, the geometry of Laplace soon found a means of explaining at least one portion of the mystery of this singular phenomenon, by the Newtonian theory of light, applied under certain supposed conditions; and the reasoning which led him to the result (at that time quite unexpected), may justly be regarded as one of his happiest efforts. The prosecution of the subject, which had now acquired a high degree of interest, was encouraged by the offer of a prize on the part of the French Academy of Sciences; and it was in a memoir which received this honourable reward on that occasion, in 1810, that Malus, a retired officer of engineers in the French army, announced the great discovery of the *polarization of light* by ordinary reflection at the surface of a transparent body. Malus found that when a beam of light is reflected from the surface of such a body at a certain angle, it acquires precisely the same singular property which is impressed upon it in the act of double refraction, and which Newton had before expressed by saying that it possessed *sides*. This was the first circumstance which pointed out a connection between that hitherto mysterious phenomenon and any of the ordinary modifications of light; and it proved ultimately the means of bringing the whole within the limits, if not of a complete explanation, at least of a highly plausible theoretical representation. So true is, in science, the remark of Bacon, that no natural phenomenon can be adequately studied in itself alone, but, to be understood, must be considered as it stands connected with all nature. The new class of phenomena thus disclosed were immediately studied with diligence and success, both abroad by Malus and Arago, and at home by our

Digitized by Google

countryman Dr. Brewster, and their laws investigated with a care proportioned to their importance; when another and apparently still more extraordinary class of phenomena presented itself in the production of the most vivid and beautiful colours (every way resembling those observed by Newton in thin films of air or liquids, only infinitely more developed and striking,) in certain transparent crystallized substances, when divided into flat plates in particular directions, and exposed in a beam of polarized light. The attentive examination of these colours by Wollaston, Biot, and Arago, but more especially by Brewster, speedily led to the disclosure of a series of optical phenomena so various, so brilliant, and evidently so closely connected with the most important points relating to the intimate structure of crystallized bodies, as to excite the highest interest,—that sort of interest which is raised when we feel we are on the eve of some extraordinary discovery, and expect every moment that some leading fact will turn up, which will throw light on all that appears obscure, and reduce into order all that seems anomalous. This expectation was not disappointed. So long before the time we are speaking of as the first year of the present century, our illustrious countryman, the late Dr. Thomas Young, had established a principle in optics, which, regarded as a physical law, has hardly its equal for beauty, simplicity, and extent of application, in the whole circle of science. Considering the manner in which the vibrations of two musical sounds arriving at once at the ear affect the sense with an impression of sound or silence according as they conspire or oppose each other's effects, he was led to the idea that the same ought to hold good with light as with sound, if the theory which makes light analogous to sound be the true one; and that, therefore, two rays of light, setting off from the same origin, at the same instant, and arriving at the same place by different routes, ought to strengthen or wholly or partially destroy each other's effects according to the difference in length of the routes described by them. That two lights should in any circumstances combine to produce darkness may be considered strange, but is literally true; and it had even been noticed long ago as a singular and unaccountable fact by Grimaldi, in his experiments on the inflection of light. The experimental means by which Dr. Young confirmed this principle, which is known in optics by the name of the *interference* of the rays of light, were as simple and satisfactory as the principle itself is useful; but the verifications of it, drawn from the explanation it affords of phenomena apparently the most remote, are still more so. Newton's colours of thin films were the first phenomena to which its author applied it with full success. Its next remarkable application was to those of diffraction, of which, in the hands of M. Fresnel, a late eminent French geometer, it also furnished a complete explanation, and that, too, in cases to which Newton's hypothesis could not apparently be made to apply, and through a complication of circumstances which might afford a very severe test of any hypothesis. A simple and beautiful experiment on the interferences of polarized light due to Fresnel and Arago enabled them to bring Dr. Young's law to bear on the colours produced by crystallized plates in a polarized beam, and by so doing afforded a key to all the intricacies of these magnificent but complex phenomena. Nothing now was wanting to a rational theory of double refraction but to frame an hypothesis of some mode in which light might be conceived to be propagated through the elastic medium supposed to convey it in such a way as not to be contradictory to any of the facts, nor to the general laws of dynamics. This essential idea, without which every thing that had been before done would have been incomplete, was also furnished by Dr. Young, who, with a sagacity which would have done honour to Newton himself, had declared, that to accommodate the doctrine of Huyghens to the phenomena of polarized light it is necessary to conceive the mode of propagation of a luminous impulse through the ether, differently from that of a sonorous one through the air. In the latter, the particles of the air advance and recede; in the former, those of the ether must be supposed to tremble laterally. Taking this as the groundwork of his reasoning, Fresnel succeeded in erecting on it a theory of polarization and double refraction, so happy in its adaptation to facts, and in the coincidence with experience of results deduced from it by the most intricate analysis, that it is difficult to conceive it unfounded. If it be so, it is at least the most curiously artificial system that science has yet witnessed; and whether it be so or not, so long as it serves to group together in one comprehensive point of view a mass of facts almost infinite in number and variety, to reason from one to another, and to establish analogies and relations between them; on whatever hypothesis it may be founded, or whatever arbitrary assumptions it may

Digitized by Google

make respecting structures and modes of action, it can never be regarded as other than a most real and important accession to our knowledge. Still, it is by no means impossible that the Newtonian theory of light, if cultivated with equal diligence with the Huyghenian, might lead to an equally plausible explanation of phenomena now regarded as beyond its reach. M. Biot is the author of the hypothesis we have already mentioned of a rotatory motion of the particles of light about their axes. He has employed it only for a very limited purpose; but it might doubtless be carried much farther: and by admitting only the regular emission of the luminous particles at equal intervals of time, and in similar states of motion from the shining body, which does not seem a very forced supposition, all the phenomena of interference at least would be readily enough explained without the admission of an ether.

## ARITHMETICAL PUZZLE.

*To the Editor of the* PENNY MECHANIC.

SIR,—The *severe* criticisms of your Solomon of a correspondent, are quite overwhelming! What profundity of thought! what depth of wisdom! what a superior understanding must he possess! Had it not been for him, probably *the slip of the pen* in my Arithmetical Puzzle, might never have been discovered, and the world would have been left in darkness; I myself, did not perceive it till after it had appeared in print, and wise "W. B." only saved me writing a letter to correct it. How many sleepless nights, and restless days, must it have cost him! And, when at last, the light burst upon his understanding, what joy! what rapture! must he have felt, to have discovered a mistake!—and, not only that, but to have rectified it also! (for it is easier by far to discover mistakes than to rectify them.)

If it is not too much presumption in one of my inferior intellect, I would tell this *light of the world*, whose wisdom far surpasseth that of Solon, that, had I taken the trouble to read over my puzzle a *second* time, I should have put "when there is no remainder, the figure struck out would be either *a nine* or *an ought*." Instead of "when there is no remainder the figure struck out would be a *nine* alone." But perhaps this wise man in the wisdom of his heart might ask, "How are you to know whether it is *nine* or an *ought*?"

This then, O! Solomon, is the way. Ask of the person, to whom you are showing the puzzle, whether the figure he struck off be *odd* or *even*." If odd say *nine*, if even say *ought*. If there *is* a remainder, of course you need not put that question. If Mr. Editor would insert the above explanatory letter, he would much oblige his

Obedient Servant,
SNUBBY GONG.

# MISCELLANIES.

*To remove Ink and Grease Spots.*—Sir,—I send the following, believing it worth insertion in your Mazazine. Nearly all the acids remove spots of ink from paper, but it is important to use such as attack its texture the least. Spirits of salts diluted with five or six times its quantity of water, may be applied with success upon the spot, and after a minute or two, washing it off with clear water. A solution of oxalic, or tartaric acid is attended with the least risk, and may be applied upon the paper, or plates, without fear of damage. These acids for taking out writing ink, and not touching the printing, can be used for restoring books where the margins have been written upon, without attacking the text. When the paper is disfigured with stains of iron, it may be perfectly restored by applying a solution of sulphuret of potash, and afterwards one of oxalic acid. The sulphur extracts from the iron a part of its oxygen, and renders it soluble in diluted acids. The most simple, but at the same time very effectual method of removing spots of grease, wax, oil, or any other fat substance, is by washing the part with ether and placing it between white blotting paper. Then with a hot-iron press above the part stained, and the defect will be speedily removed. In many cases where stains are not bad, rectified spirits of wine will be found to answer the purpose.

I remain Yours, &c.
G. H. M.

*The Hindoostan Lapidaries Wheel.*—This wheel is extremely useful for cutting patterns on glass, engraving on crystal, filing metals, sharpening instruments, and many other purposes besides the work of a lapidary. It is composed of two parts of fine emery powder, and one part of gum-lac. The emery is put into a crucible, and when hot enough to melt the lac, throw in some pieces one by one, stir the whole well, and make the mixture as complete as possible, and then pour it on a smooth marble slab; after beating it well with a pestle, roll it on a stick and heat it again, &c. When the mixture is perfect,

Digitized by Google

you pour it on the marble slab, (pounced with emery) in a hoop of iron or wood forming a mould, flatten and press in the paste with an iron roller, and smoothen the surface with a piece of iron and emery, heat the iron mandril and pass it through the centre, when cold it is applied to the lath and fit for use. The composition of the wheel is not only durable and simple, but may be less costly if applied as a ring on to the circumference of any other wheel, although generally made solid by the Hindoostan. P. H. D.

*National Baths, Westminster Road.*—We had the pleasure of visiting these baths a few days since, and were much gratified at perceiving, that the three-penny tepid bath, noticed some Numbers back, was now opened, and that the mechanics duly appreciated the advantages it afforded them. It it certainly one of the finest baths in the metropolis.

*The Grand Junction Railway* of Liverpool and Birmingham will be opened to the public, it is confidently expected, in the course of the ensuing month.

*Mail-Coach Drag.*—The new mail-coaches have a piece of machinery attached to the hind part of the mail, for the purpose of locking down the steep hills without the guard's getting down, or, in case of the horses running away down a hill, of stopping the mail instantly. The contrivance is very simple, and is done by the pressure of two pieces of wood against the wheels: the connecting rod going to the top of the coach is turned by a screw, and the effect on the wheels is immediate.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, June 28, Colonel Thompson, M. P., on the Corn-Laws. Friday, 30, J. Pereira, esq., on the Senses, both at half-past eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, June 29, N. F. Zaba, esq., on the Literature of Poland, at half-past eight.

*Aldersgate-street Institution*—Wednesday, June 28, T. King, esq., on the Nervous System of Man, at eight.

*Eastern Athenæum.*—Wednesday, June 28, Dr. Birkbeck, V. P. of the Institution, on the Measurement of Time, at eight.

*Poplar Institution*, East India Road.—Tuesday, June 27, Robert Brindley, esq., on Naval Architecture, and the causes of Shipwreck, with Diagrams and illustrations, at eight.

*Mechanics' Institution*, New Road, near Gower Street.—Tuesday, June 27, Mr. Angell, on the Steam Engine, at eight.

*Kentish Town Mutual Instruction Society.*—Monday, June 26, M. Gregory, on Botany, at half-past eight.

*Finsbury Mutual Instruction Society.*—Tuesday, June 27, Col. Thompson, M. P., on National Economy: The Corn-Laws, &c.—Thursday, 29, A Concert by the Members of the Choral Class and others, at half-past eight.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Fireworks.—Coloured Fires.*—Sir,—N. N. who has in your last Number of the PENNY MECHANIC answered my Query respecting "Coloured Fires," must know very well, if he has tried the compositions he gives, that neither of them burn like the colours he says they do; I have tried them all, and I find the only one that burns is the Spur Fire, but that is not a coloured fire.

Yours, &c. A. B. Y. Z.

Sir,—I shall be much obliged if some of your readers can inform me, how Park's Fusible Alloy is made, or where it could be bought. Also how Blue Lights are made, such as they use for signals at sea, &c.

Your obedient Servant, D. J.

Sir,—Being engaged in constructing a Phantasmagoria of large powers, I am desirous to dispense with the unsightly appearance of a chimney. If any of your intelligent correspondents will inform me, through the medium of your valuable Periodical, of the best plan for condensing or consuming the smoke, they will oblige your constant reader,

A. M.

## TO CORRESPONDENTS.

A. W. *The Parachute will open without assistance when descending. A solution of Alum will perhaps do.*

D. J. *Any work on Electricity will give him better information on the subject than he could obtain by an answer to his queries.*

J. Johnson. *Hydrogen gas. It may be obtained by pouring a little diluted Sulphuric Acid (oil of vitriol) on a few pieces of granulated zinc in a bottle.*

*Will* A. M. *be kind enough to point out the errors in the drawing, if they are important, not otherwise.*

F. V. E's. *drawing and description of a cheap* Electrical Machine *shall appear in an early Number. It is very ingenious.*

C. H. S. *must condense the matter into a smaller compass than what he mentions.*

*Has* M. N *got a model of his Paddle Wheel that he could leave with our publisher for a few days in order that we might see it? We are afraid* M. N's *description of the drawing would not be fully comprehended, and we cannot well alter it without seeing the model.*

C. D. Thomas, *next week.*

S. W. *and* A Mechanic, *shall receive our best attention.*

*A report of the Evidence of the Scientific Men examined at the late Inquest at Hull, respecting the cause of the explosion, is unavoidably postponed this week.*

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

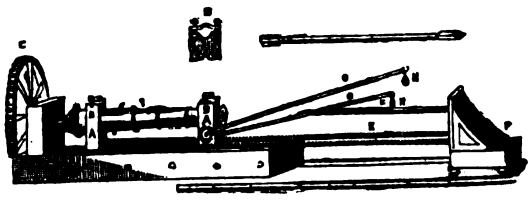
Digitized by Google

# THE PENNY MECHANIC.

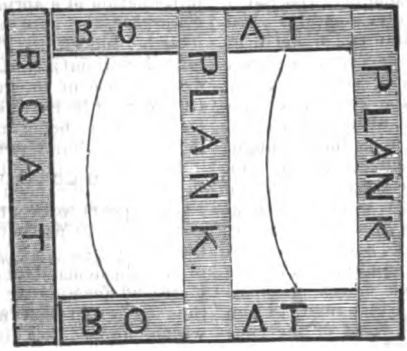
A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXXVI.] SATURDAY, JULY 1, 1837. [Vol. I.

METHOD OF BORING CANNON.—Fig. 1.



MACHINE FOR RESCUING PERSONS FROM THE ICE.—Fig. 2.




IMPROVED SAFETY LAMP.—Fig. 3.

IMPROVED PIN DRILL.—Fig. 4.

Holloway Press: D. A Doudney.

Digitized by Google

## CASTING AND BORING CANNON.

FIG. 1.

CANNONS are cast from wooden models, which have been exactly and smoothly turned at a lathe, so that they may leave the sand with facility during the process of moulding; and as the model does not admit of being drawn from the sand like a smooth cylinder, they are moulded in boxes opening along the sides. The metal is required to be of the best quality, and along with the common sort, it is usual to mix the superior Welsh pig iron, and that drawn from the rich ores of Cumberland.

Every gun, previous to its being bored, is fixed in a stout iron frame between two centre points, and engine-turned all over the outside with sharp steel tools properly fashioned. It is then carried to the boring engine, and placed horizontally in two massy cast-iron supporters, represented in the engraving at A, A, each containing a hollowed brass gully exactly fitting to the gun at the breech and at the neck, and over which the collar B is screwed down, that the piece may revolve steadily. It is then connected with the cog-wheel C by means of a square iron box at D, a square knob of a corresponding size being cast upon the breech of the cannon for this purpose, but which is ultimately cut off. The sharp steel drill E is then brought into contact with the muzzle of the gun, by advancing the carriage F, the front of which, bearing the borer, is a massy metal plate, strengthened by brackets from behind, and resting upon a cube of solid iron about nine feet square, and twelve inches thick, and which moves on small truck wheels along a metal road. Upon the square projecting axles of the cog-wheels on either side of the supports are next placed the levers G, G, and upon these the weights H, H; the gun I is then made to revolve slowly by putting in motion the wheel C. From the sketch it will be obvious, that when the drill is brought into contact with the piece to be bored, and the latter turned round by the machinery, the effect of the levers through the operation of the pinions upon the two racks K, K, must be by maintaining a constant pressure to keep the drill to its work; the levers, meanwhile, as their weights respectively approach the floor, being taken off and replaced at their first elevation till the boring is completed; which, in a thirty-eight pounder, will generally require about forty-eight hours, including two or three stoppages to sharpen the drill. The racks are about twelve feet long, and the other parts of the machinery in proportion; the whole being exceedingly massy, and firmly bound together.

When the gun has been bored to the proper depth by this process, the drill is removed, and another instrument introduced into its place consisting of a shaft of iron, shod at the extremity with four or five square bits of steel, attached by longitudinal groves to the rod. This being introduced, widens the bore about the eighth of an inch, at the same time smoothing and perfecting the calibre to the exact dimensions required.

An idea must naturally present itself to the most indifferent observer, that to cast the guns hollow at once, as it would involve no difficulty, so it would not only facilitate the work, but save a deal of expense consequent on the tedious process of boring the solid metal. This plan has been tried, but abandoned as unsatisfactory; it being found almost impossible thereby to get the inside quite free from flaws; and, as every piece was not only proved at the arsenal, by firing double charges, but examined throughout by the introduction of a spring instrument, called a *searcher*, the core-cast cannon were rejected. Indeed it will be universally admitted, without adverting to the direct and dreadful use of the guns, that too great care cannot be exercised to prevent artillerymen from being unnecessarily endangered by the bursting of imperfect metal.

Happily for the interests of humanity, the business of cannon-casting on the large scale appears to be at an end; the foundery being at present at work chiefly for the arts of peace. Since the introduction of gas, the demand for cast-iron piping has increased amazingly; and it is gratifying thus to reflect that much of the metal which, under other circumstances, might have composed a "devilish enginery" for carrying death through ranks of our fellow-men, is now used for the economical conveyance of the pabulum of illumination through our towns, manufactories, and dwelling-houses.

Some idea of the quantity of cast-iron which at one period was consumed in the article of guns, &c. may be formed from the fact that, about 1795, the average amount of metal purchased by the Board of Ordnance in the state of cannons, mortars, carronades, shot and shells, taking the account of three years, was estimated at nearly 11,000 tons annually. The India company took for a yearly supply about half of that amount, i. e. 5,000 or 6,000 tons; and besides these two items, other armed trading vessels were said to purchase 10,000 tons, making a total of 26,000 tons of iron annually cast into that "devilish enginery," at the explosion of which, so oft, by sea and land, thousands were laid low.

Digitized by Google

## MACHINE FOR RESCUING DROWNING PERSONS FROM THE ICE.

FIG. 2.

*To the Editor of the* PENNY MECHANIC.

SIR,—The ingenious contrivance produced by your correspondent "H. P.," page 27, for rescuing persons from the ice, suggested to me the following plan. I must first premise that every apparatus for the same purpose I have ever heard of, (including that of "H. P.'s") is upon the principle of making the persons in the water *help themselves* out by their own strength, which appears to me defective, as means must frequently be required to take out a person too insensible for exertion. Now I believe the following plan would fully answer, even in cases where a sufferer might be drowning *under* the ice without any part of his body being seen; and the machine is so evidently safe for those who are to work it, that when an accident might occur requiring it, the most timid persons would feel no hesitation in conveying it to the sufferer, even if in doing so they had to pass over ice as dangerous as that to which they might be hastening.

The following is an explanation of the drawing. Three boats of wicker work with wooden circular bottoms, are made watertight by a covering of canvass and caoutchouc varnish. The boats are twelve feet long, two feet wide, and four feet deep, and are placed to form three sides of a square, while two planks twelve feet long, a foot-and-a-half broad, and two inches in thickness are placed at equal distances over the tops of the *two parallel boats*; one of the planks forming the fourth side of the square. The two parallel boats have small iron keels to assist their running over the ice; the third has no keel, and while the others are sliding does not touch the ice. Ropes fastened to the two parallel boats hang from one boat to the other, reaching the ice in the centre. This machine in the water would buoy up as many persons as could well lay hold of it, and therefore when an accident occurred, two or three of the nearest bye-standers would be sure to volunteer for the rescue. Arrived at the hole made in the ice, the plank side of the machine, (the side without a boat), is passed over the head of the person in the water if he be visible, and one of the rescuing party, getting on the plank over the hole, helps out the sufferer; but if the body has sunk under the ice, the party immediately set to work with hatchets, and breaking the ice by the sides of the boats, bring out the body dead or alive, without the least risk to themselves, as they are either in the boats or on the planks. If the ice be much broken during the rescue, a rope is flung from the shore, and the machine hauled over the hole either by the party themselves or those on shore.

I am not aware that any similar or better plan than the above has been suggested; but I am quite convinced that no plan will approach it in point of utility which has not a provision for taking bodies out of the water when in a state of insensibity.

Yours, &c.

G. P. P.

## IMPROVED SAFETY LAMP.

FIG. 3.

*To the Editor of the* PENNY MECHANIC.

SIR,—The following is a description of a Safety Lamp to be used in coal mines, and which I imagine will be an improvement on the Davy Lamp.

DESCRIPTION.

The lamp A is a glass lens round the flame of the lamp, which makes the light stronger; B is a circular piece of iron, with a worm made fast to the wire gauze; C is a lid to screw on the iron. It will be seen that this lamp is calculated to give more light than the common ones, where the wire surrounds the flame. The lid is to be taken off when the lamp requires trimming.

I am, Sir,
Your Subscriber,

C. C. W.

[The glass funnel might have a male screw on each end, and thus be screwed on to the gauze wire above and below the glass.]

## IMPROVED PIN DRILL.

FIG. 4.

*To the Editor of the* PENNY MECHANIC.

SIR,—I send a description of an improved pin drill, which is used for large lathes with iron beds. This is called a pin drill, from its having a pin at the end of it; as will be seen in the drawing. It is used for drilling large work, when the common drill will not do. This drill is for drilling iron.

DESCRIPTION.

*a* is the cutting parts, *b* is the pin, at the end of which is another drill c, which is my improvement. This drills with the other. Now it will be seen that a great deal of time is saved, for in the old drills the pin is plain, and requires another drill

Digitized by Google

to be drilled through the work, when sometimes there is not a drill of the size of the pin. The drill at the end of the pin remedies this; it works with the other drill. If you think this worth your notice an insertion will oblige

Your Subscriber,
C. C. W.

## STEAM BOILER EXPLOSION AT HULL.

SINCE our last account of this accident the coroner's inquest has concluded its labours; and the jury have returned a verdict of manslaughter against the engineer. The evidence of the witnesses who were examined for the purpose of ascertaining the cause of the explosion is not satisfactory, but the general opinion appears to be that it was occasioned in consequence of there not being a sufficiency of water in the boiler. One of the witnesses, however, Mr. Lewis, most positively contradicts this; he says, "I tried the gauge taps, which are placed in the boiler to ascertain the height of the water; the first emitted nothing but pure steam; there was no peculiar colour or smell about that steam; the second (the lower tap) let out water, which flowed for I dare say a minute and a half, in consequence of my not being able to turn the cock. Boilers are considered safe when there is water in the lowest tap, and steam in the two top ones. The use of these taps is to keep the water between the top taps and the bottom one. The explosion took place within two minutes of my trying the gauge tap, and from the trial of the taps I should consider the boiler quite safe." Mr. James Overton, of Hull, boiler maker, stated that he had seen the engine and boiler of "the Union" about two months ago; the boiler was then in a sound state, and capable of bearing a pressure of 10lbs. on the square inch; and he considers it might have borne 40lbs. to the square inch without bursting. The safety valves had not a greater resistance than 8lbs. to the square inch. He thinks the cause of the explosion to have been the want of water in the boiler, and that probably the water having been decomposed, and the hydrogen mixed with oxygen from the atmosphere, the explosion of these gases produced the mischief. There is, however, some difficulty in accounting for the presence of a sufficient quantity of oxygen to produce so great an explosion. The atmosphere can hardly be supposed to have passed into the boiler, and hydrogen itself will not explode unless mixed with oxygen. Mr. Vernon, engine manufacturer, stated most positively, that air could not descend through the safety valve when open, if the interior of the boiler were full of gas, because there would be a greater pressure outwards than inwards, but he thought the gas might ignite itself! We think this must be a mistake of the reporter or printer, because when water is decomposed into its elements in a boiler, it is always considered to be in consequence of the iron boiler having a greater affinity for the oxygen of the water than the hydrogen has, and the latter is consequently set at liberty. This is the reason why *copper* boilers would be so much safer, since they would not decompose the water so readily as iron boilers; but there appears to be something inexplicable respecting the mixture of the gases that has always baffled inquiries into the causes of steam-boiler explosions. Mr. Barrett, another engineer, said, "I suppose the explosion in question was occasioned by too small a supply of water being in the boiler, which being exhausted, the tops of the flues became bare, and the fire continuing to act upon them, they became red hot, and then the water was decomposed, and the quantity of steam generated, decreasing, and the act of decomposition increasing; this process would go on till the whole mass became gas; the tops of the flues continuing hot, the gas would become more and more rarified till ignition took place. I cannot determine whether it would ignite without coming into contact with atmospheric air, *I think it would.*" Mr. A. Y. Barrett is of the same opinion. From this evidence it will be perceived that three scientific men think that the explosion might take place *without the admission of atmospheric air into the boiler.* The evidence to show that the generation of high pressure steam was not the cause of the accident, is very strong. Besides the fact that it might have escaped by the safety valve, the manner in which the boiler burst showed that it must have been by some tremendous power suddenly generated. If there had been five times the ordinary pressure on the boiler it would not have burst; it would only have bulged, from the giving way of the stays. Mr. Vernon says that whenever boilers are burst from the force of steam, they are always rent in the weakest part; pieces of the boiler are not detached. He did not think a boiler like that of the Union *could* be burst by steam. Some of the witnesses, however, were of a different opinion. The question relative to the cause of the explosion is still unsettled, but perhaps there may be some further light thrown upon the subject before the trial of the engineer takes place.

Digitized by Google

## ON AEROSTATION.

NO. I.

In the year 1707, as we are informed by a letter published in France in 1784, a projector, Friar Gusman, applied to the king for encouragement to his invention of a flying machine. The principle, if it had any, seems to have that of a paper kite. The machine was in the form of a bird, and held several tubes through which the wind was to pass, in order to fill a kind of sail, which was to elevate it; and when the wind was deficient the same effect was to be performed by means of bellows concealed within the body of the machine. The ascent was also to be promoted by the electric attraction of pieces of amber placed in the top, and by two spheres inclosing magnets in the same situation. The king to encourage him to proceed, granted a place in his college of Barcelos or Santarem, with first professorship in the University of Coimbra, and an annual pension of 600,000 reis during his life. Of this De Gusman, it is also related, that in the year 1736, he made a wicker basket of about seven or eight feet in diameter, and covered it with paper which raised itself about 200 feet in the air, and the effect was generally attributed to witchcraft.

In the year 1766 Mr. Henry Cavendish ascertained the weight and other properties of inflammable air, determining it to be at least seven times lighter than common air. Soon after which it occurred to Dr. Black, that perhaps a thin bag filled with inflammable air might be buoyed up by the common atmosphere; and he thought of having the allantors of a calf prepared for the purpose, but his other avocations prevented him from prosecuting the experiment. The same occurred to Mr. Cavallo; and he has the honour of being the first who made experiments on the subject. He first tried bladders; but the thinnest of these, well scraped and prepared, was found too heavy. He then tried Chinese paper, but that proved so permeable that the vapour passed through it like water through a sieve. At the same time, on the continent they were not asleep; for in 1782, two brothers, Stephen and John Montgolfier, natives of Annoway, paper manufacturers, turned their thoughts to the subject. The idea was first suggested by the natural ascent of smoke and clouds in the atmosphere, and their design was to form an artificial cloud by inclosing the smoke in a bag, and making it carry up the cover with it. Towards November in that year, it was tried at Avignon with a fine silk bag of a parallelopiped shape. By applying burning paper to the lower aperture the air was rarified, and the bag ascended in the atmosphere, and struck rapidly against the ceiling. On repeating the experiment in the open air, it rose to the height of seventy feet. An experiment on a more extended scale was now projected, and a new machine containing about 650 cubic feet was made, and it rose about 600 feet. An immense bag of linen lined with paper and containing upwards of 23,000 cubic feet was found to have a power of lifting about 500lbs. besides its own weight. The operation was begun by burning chopped straw and wool under the aperture of the machine, which immediately began to swell. One of the brothers constructed a large balloon of an elliptical form at Paris, sixty feet high, and forty feet in diameter. In a prelimanary experiment the machine lifted up from the ground eight persons, and would have carried them off if others had not come to their assistance. The great power of these machines, and their very gradual descent, had originally shown they were capable of transporting people through the air with all imaginable safety: as M. Mongolfier proposed to make a machine of a firmer and better construction, M. Pilatre de Rozier offered himself to be the first aerial adventurer.

This new machine was of an oval shape about forty-eight feet in diameter, and seventy-four feet high, painted outside with the signs of the zodiac cyphers of the king's name, and other ornaments. A proper gallery grate, &c. were appended in the manner afterwards described; so that it was easy for the person who ascended to supply the fire with fuel, and thus keep up the machine as long as he pleased. The weight of the whole apparatus was upwards of 1,600 lbs. The experiment was performed on the 15th Oct. 1783: with this machine M. Pilatre in calm weather ascended 210 feet; some time after he ascended with M. Girond de Vitell to the height of 230 feet, hovering over Paris for above nine minutes, the machine keeping perfectly steady. On the 21st of Nov. 1783, M. Pilatre determined to undertake an aerial voyage, in which the machine should be fully set at liberty, it being held with ropes before. Every thing being got in readiness, the balloon was filled in a few minutes; and M. Pilatre placed himself in the gallery, counterpoised by the Marquis d'Orlandes, who occupied the other side. They met with no inconvenience during their voyage, which lasted about twenty-five minutes, during which time they had passed over

Digitized by Google

a space of about five miles. From the account given by the Marquis d'Orlandes, it appears that they met with several different currents of air; the effect of which was to give a very sensible shock to the machine, and the direction of the motion seemed to be from the upper part downwards. It appears also, that they were in some danger of having the balloon burnt altogether, as the Marquis observed several round holes made by the fire in the lower part of it, which alarmed him considerably. The progress of the fire was easily stopped by the application of a wet sponge, and all appearance of danger soon ceased.

C. H. S.

## DOMESTIC WATER MILLS.

*To the Editor of the Penny Mechanic.*

*Lisieux, Normandy, June* 12th.

SIR,—I have received your interesting miscellany at this place, and should I stumble now and then on a good scientific article in the French journals, I will translate and send it you.

A week or two ago, while making a journey to Havre, I found that in consequence of my availing myself of a seat in a private conveyance which started before the coach, and was going part of the way, that on arriving at Pont l'Eveque (a town midway between Lisieux and Honfleur) I had an hour to spare, the deligence being far behind. This leisure I occupied with a stroll up the principal street, giving the little French boys and girls an opportunity of staring at a foreigner, and myself the satisfaction of observing them. On crossing a little bridge thrown over a narrow branch of the main stream which runs through the town, my eye accidently rested on a flour-mill; but from the absence of the external features of such buildings, I was induced to examine it with some attention. The front was in the street, and the wheel was attached to the side wall nearest the water, consequently, having the whole of its parts exposed to view. This position of the water-wheel is very common in this part of France; but I never remember to have seen it in England, except in drawing master's copies of picturesque scenery, and in those touched up duplicates of the same with which wonderful sons astonish their mothers at vacation time. Leaning over the bridge, I was surprised to observe the longitudinal narrowness of the wheel, and the very inconsiderable slip of water that was necessary for its action. The length of the paddles could not, I think, have been more than eighteen inches; and though the wheel, from its great height, must have been very heavy, the little fall of water (about two feet in width) was sufficient to turn it in a very vigorous manner. Seeing the small space that was occupied, and the sufficiency of so trifling a fall, the question occurred to my mind,—why are not water-wheels fixed in the kitchens or sculleries of hotels, eating-houses, coffee-shops, and private establishments where there is a great deal to do? Might not a tank or cistern of rain water, aided by a pipe from the water-works, supply a stream, which flowing in a trough or channel, might fall on the paddles of a small wheel? The form of this trough or artificial channel, its relative position with the wheel, and the height of the fall, are a detail of easy arrangement which common workmen practically understand. To the shaft of this wheel, might not a sufficiency of appropriate gear be attached to carry on a variety of domestic operations, such as coffee-grinding, spit-turning, pumping, &c. &c.? And might not the water, after it has performed its functions, be pumped up again into the original tank or cistern of supply? In this age of the march of mind, it is highly desirable to have some cheap and simple machinery to discharge the coarser labours of servants, who, very properly, wish to avoid unnecessary domestic drugery. Though many look forward to the days when steam-engines will be applied to this purpose, there is, and will be, for some time, two obvious impediments to their domestic use; one is the expense; and the other is the danger from accident or carelessness. Both these objections have been greatly mitigated of late, and will, no doubt, greatly lessen in future; but, at present, it is, I think pretty obvious that water power, although less convenient and efficient than steam in large undertakings, is much more economical. One of the objections that might be raised against having a water-wheel in a house, is, the disagreeable noise. But this would be only a temporary matter, and might be mitigated by placing the wheel outside the house, and in a situation where it could be as little offensive as possible "to ears polite."

To throw down a vague scientific idea on public ground requires a little courage in these days of criticism; but I feel neither afraid nor ashamed. In matters of practical science my opportunities have never corresponded with my taste and desires; and my pursuits have been of a different kind. It is possible, therefore, that my scheme may be impracticable in

Digitized by Google

consequence of my having overlooked many little impediments in detail with which practical men are alone familiar. Imperfect knowledge, when it is not accompanied with presumption, is neither criminal nor disgraceful; and I consider it not one of the least advantages of magazines like yours, that they indulgently afford to intelligent crudities, "a local habitation and a name." In this way mind is made to assist mind. The experience of one supplies the deficiencies and corrects the false data that are the consequence of the inexperience of another; and the stimulus of publication causes many young amateurs of science to follow up their ideas, and teach them "how to shoot," and to set aside many early errors which they would otherwise have continued to regard as truth and the *ne plus ultra* of the matter.

That the PENNY MECHANIC will be the friend of the *pennyless* mechanic, and the liberal advocate of science, is what I sincerely hope, and have reason to believe, from the evidence afforded by the Numbers that have been hitherto published.

Your obedient Servant,

E. A.

## MISCELLANIES.

*To make Ginger-Beer Powders.*—Take two drachms of fine loaf sugar, eight grains of ginger, and twenty-six grains of bicarbonate of potash, all in fine powder—mix them intimately in a Wedgewood's-ware mortar. Take also thirty grains of citric or tartaric acid, (the first is the pleasantest, but the last the cheapest.) The acid is to be kept separate from the mixture. The beer is prepared from the powders thus: take two tumbler glasses, each half filled with water—stir up the compound powder in one of them, and the acid powder in the other: then mix the two liquors—an effervescence takes place—the beer is prepared, and may be drunk off. The effervescence is occasioned by the discharge of the carbonic acid of the carbonate of potash. If the beer is allowed to stand for a few minutes, it becomes *flat:* this is owing to its having lost all its carbonic acid.—The cost of these powders is about sixpence a-dozen sets.

*The Weavers.*—The arts of spinning, throwing, and weaving silk were first introduced into England about the middle of the fifteenth century, and were then practised in London by a company of women, called, from the nature of their occupation, silk-women. About 480 men began to engage in the silk manufacture, and in the year 1686 nearly 50,000 manufacturers of various descriptions took refuge in England in consequence of the revocation of the edict of Nantes by Louis le Grand, who sent thousands of the most industrious of his subjects into this kingdom to present his bitterest enemies with the arts and manufactures of France, and hence the origin of the silk trade in Spitalfields.

## INSTITUTIONS.

*London Mechanics' Institution.*—As we are frequently receiving letters from Correspondents, requesting to know the terms of subscription, &c., to the different Literary and Scientific Institutions in the metropolis, we intend to give a short account of them in our succeeding numbers. By this means our readers will be able to make a choice if they wish to belong to any of them, and we shall afford the educationist a glimpse of the means now in use for the improvement of the people of the metropolis. We think we are acquainted with nearly all the Mechanics' and Literary Institutions of London; but we shall be happy to receive information from their Secretaries or members, in order to prevent the possibility of any misstatements. The first we shall notice is one that deserves this distinction, not only on account of its being the first established, but also because it is probably more interesting to our readers than any other. The London Mechanics' Institution, situate in Southampton-buildings, Chancery-lane, Holborn, was established on the 3rd December, 1823. Before this period the mechanics of London did not possess the advantages enjoyed by many of their Scottish brethren for obtaining scientific knowledge; and great honour is due to those excellent gentlemen who originally proposed and formed an Institution for improvement of *work-ng men.* Every member, by paying *six shillings a quarter,* and two shillings and sixpence entrance fee, is entitled to the following advantages:—*Lectures* every Wednesday and Friday evenings, at half-past eight o'clock, on different branches of science and literature. A *Library* of excellent books. There are nearly 7,000 vols. for circulation and reference. There are also *Reading Rooms,* supplied with nearly all the morning and evening newspapers and magazines. *Classes* for the study of almost every branch of knowledge. Most of these classes are under the direction of

Digitized by Google

teachers, and a small additional subscription is required in order to belong to some of them. The affairs of the Institution are conducted by a President, four Vice Presidents, and 30 Committee men, who appoint a Secretary. Fifteen of the Committee go out of office by rotation every six months, and are not eligible to be elected until they have been out of office for a similar period. Two-thirds of them are obliged to be chosen from among the working clases. The average number of members is about 1,200.

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, July 5, Colonel Thompson, M. P., on the Currency.—Friday, 7, J. Pereira, esq., on the Senses, both at half-past eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, July 6, Mr. Moore, on Poetry and the Living Poets, at half-past eight.

*Eastern Athenæum.*—Wednesday, July 5. No lecture.

*Poplar Institution*, East India Road.—Tuesday, July 4. No lecture.

*Gower Street.*—Tuesday, July 4, Mr. Angell, on the Steam Engine, at eight o'clock.

*Finshury Mutual Instruction Society.*—Tuesday, July 4, the Author of "The Mechanics' Saturday Night," on the Love of Praise, at half-past eight.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—I should be very much obliged if you or any of your correspondents would inform me of the best material to make a Fire-balloon for aeronautical purposes: and also the best method of making it air-tight and fire-proof: you will greatly oblige,

Your obedient Servant. H. F.

[The "Mongolfiers" described in Number 28, would probably suit "H. F." better than one of his own making. They are very cheap, and may be procured at Darton's, on Holborn Hill, and of other respectable Booksellers and Stationers.]

Sir,—Knowing that your valuable paper is the vehicle for the disseminating and interchanging of knowledge, I take the liberty of putting two questions, to which some of your numerous readers will, no doubt, furnish answers.

The first, put to me by a friend, and which I was not able to reply to, is, "by what principle are the Steam Packets worked, which run between London and Westminster Bridges," the propelling force of which is (as I am informed) Mercury.

The second is to know the cause of, what appeared to me, a curious phenomena; namely, I being on the platform in the large room at the Crown and Anchor Tavern, on Monday, at the meeting of the Working Classes, was struck with the distinct echo, which at the commencement of the evening, followed the expressions of the speakers. But I was no less surprised, when at the conclusion of the business, or I should say towards the conclusion, the voices of the speakers were not resounded at all. I judged whether the air, by being impregnated with the carbon (which I have understood, human beings, as likewise other animals, give out) escaping from the auditory, became thereby a less conducting medium. If you, or some of your readers, will be so good as to reply to the above, you will oblige,

Sir, A LOVER OF SCIENCE.

### ANSWERS TO QUERIES.

*Permanent Ink for Marking Linen*—Dissolve a drachm of lunar caustic (fused nitrate of silver) in thrice its weight of distilled (or rain) water, and add about half a drachm of gum-arabic. This forms the ink, with which you must write or rather paint, with a clean pen upon the linen prepared as follows:—dissolve half an ounce of subcarbonate of soda in an ounce of distilled water, and add twenty grains of gum-arabic, this forms the mordant. Well moisten with the mordant the part of the linen that is to be written on, dry it by a gentle heat and then apply the ink in the manner above directed to the place that has been moistened The writing when exposed to the sun becomes black.

J. R. WATTS.

*Living Models.*—There are occasionally a few artists who collect a certain sum for the purpose of studying the life, generally for a season only, when another assembly is formed. However, there is a sort of academy in Sutton-street, Soho Square, between the Catholic Chapel and Music shop (corner house), where persons are admitted on paying the requisite fee, and have an opportunity of studying from the living model.

P. H. D.

## TO CORRESPONDENTS.

*The Letter respecting the* Quarterly Meeting of the London Mechanics Institution, *shall be inserted.*

Z. Z.'s *communication is too personal and offensive to be published.*

Mr. Saul, of Lancaster, *shall receive a private communication.*

S. W. *We will give an engraving of a Steam Boiler in an early number; he will then perceive that some of his suggestions are acted upon at the present time, and perhaps be able to improve upon them.*

Saint Monday—School of Design—The Human Body, *and the insertion of one or two papers that are accepted from Correspondents, have been unavoidably postponed.*

*We have not overlooked the papers sent us on* Perpetual Motion, *but other more pressing subjects have hitherto prevented our publishing them.*

T. B—*We beg to inform this Correspondent, and several who have written at different times to know if we would introduce* Chemistry *into the Magazine that we now intend to do so. The first paper will probably appear in our next number.*

Mechanicus *declined, with thanks.*

Verulam Philosophical Society of London *shall appear next week.—We are much obliged to* Professor Dewhurst *for his kind offer, and shall feel happy in inserting any papers he may be pleased to favour us with.*

*Received* Operative Mechanic *and* Jack's Brother.

*Received* F. V. E.—A Reader, *and several* Queries *and* Answers.

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

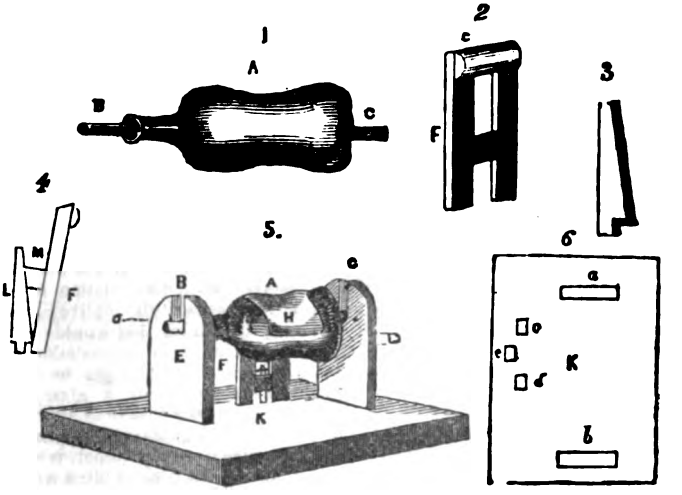
Digitized by Google

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXXVII.] SATURDAY, JULY 8, 1837. Vol. I.


## CHEAP ELECTRICAL MACHINE.




## PERPETUAL MOTION.

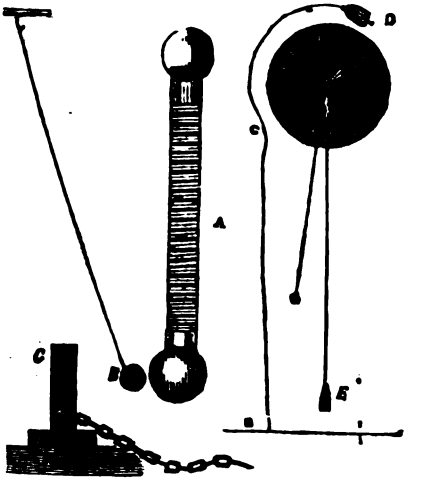
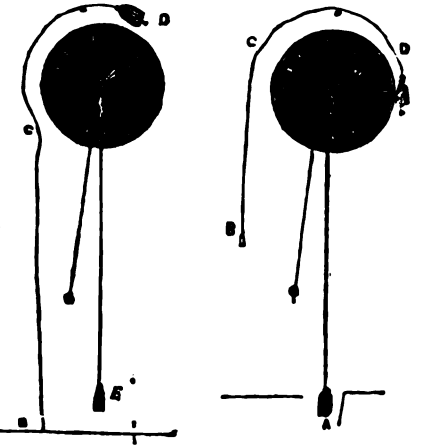



Fig 1. A SIMPLE ALARUM. Fig. 2.





Vol. I.—No. XXXVII. Holloway Press: D. A. Doudney.



Digitized by Google

## CHEAP ELECTRICAL APPARATUS.

SIR,—Thinking the following description of a simple electrical machine would be acceptable to your readers, I take the liberty of requesting the insertion of it in your cheap and useful periodical, if you consider it worthy of that honour.

Fig. 5 shows the machine complete. The construction of it is as follows:—Make a hole through the bottom and opposite the mouth of a common wine bottle (A, fig. 1), about the same size as the mouth; through this hole and the mouth pass a spindle (BC),—the end B of which should be squared to fix a handle on—and fix it firmly in the bottle. The bottle is then fixed in the frame (fig. 5) in the following manner: the end of the spindle (C) passes through a hole (the diameter of which is the same as that of the spindle,) in the upright *c*, and the end B slides down the groove E (in the other upright), the bottom of which is the same height as the hole in the upright *c*, so as to keep the bottle in a horizontal position; the spindle is kept from starting up by passing a pin through the upright in the direction of the line *a*. Next make a cushion of washleather, stuffed with wool, and fasten it on the top of the frame E (fig. 2) with glue; this frame is to be of such a height that the cushion shall press against the side of the bottle; a piece of black silk (which for the sake of clearness is omitted in fig. 2, but is marked H in fig. 5,) is to be sewn on the top of the cushion, and is to hang over the bottle as represented in fig. 5. The method of keeping this cushion pressing against the bottle will be better understood by reference to fig. 6, which is a plan of the board K, in which the uprights are fixed. *a* and *b* are the places of the uprights; *c* and *d* are the holes in which the ends of the cushion frame are put; a long wedge (represented in fig. 3,) is put in the hole *e*; another wedge is then put between the cushion frame and upright wedge: this is better explained, perhaps, by fig. 4, where F is the cushion frame (or rather a section of it); L the upright wedge, and M the wedge which is put between the cushion frame and upright wedge. The cushion should be smeared with a mixture of quicksilver scraped from the back of a looking-glass, and tallow. Before the machine is used, the bottle had better be held before the fire for about half a minute to insure its not being damp.

The conductor may be made thus:—At right angles to one end of a cylinder of wood, about 2½ inches in diameter and 6 inches long, fix a smaller wooden cylinder, about ¾ of an inch in diameter, and 3 inches long, rounded at both ends; the other end of the larger cylinder is to be rounded. Cover the whole with tinfoil, and mount it on a stand with a glass rod. When used it is to be placed with the cross piece parallel to, and within about half an inch of the bottle, and should be of such a height as to come just below the silk apron. The leyden phial described by J. H. is to be placed at the round end of the conductor. If the cushion is pressed against the bottle with the hand, the machine will be found to work better.

I am, Sir, yours respectfully,
F. V. E.

## THE NEAREST APPROACH TO PERPETUAL MOTION.

THE following is the nearest approach to that "*opprobium philosophicæ*," the perpetual motion. It is not liable to the resistance offered by friction, or to the disparity between the motive power and the reciprocal force that would keep it in motion, which is an irremediable objection to all *mechanical* attempts to effect it. It consists simply of a glass tube filled with successive pairs of silver and copper leaf (Dutch gold leaf), separated by pieces of common writing paper, in alternate layers, until the tube is filled with the series. Thus constructed, it forms what is known to electricians by the name of "De Luc's Electrical Column," and if closed from atmospheric access by a brass knob at each end, is capable of yielding electricity of considerable tension, and will remain in action for years. The hygometric moisture contained in the paper producing sufficient oxidation of the copper leaf, and corroding it very slowly, so as to develope a continuous current of voltaic electricity, a pith ball (B) is suspended by a single fibre of spun silk, so as to vibrate readily between one of the brass knobs of the tube, and a piece of wood (C), covered with tin foil, placed on a table, or connected to the ground by a chain. Under this arrangement, the feeble current of electricity will first attract the pith ball, then having communicated to it an excess of electricity, it will become positive, and be immediately repelled, until it touches the tinfoil conductor, where it parts with its excess of electricity, and becomes negative, returning to its perpendicular position again, when it is again attracted and repelled as before; this repulsion is owing to the well-known law that bodies *similarly* electrified always repel each other, while those in an *opposite* state of excitement exert an at-

Digitized by Google

tractive influence. Thus the same effects being constantly produced, the vibration of the pith ball will continue as long as the electric current exists, which, if the outside of the tube be kept clean and dry, may be for an indefinite number of years.

BRACK HIMSELF!

## A SIMPLE ALARUM.

SIR,—In reading your valuable journal of the 10th of June, I observed a letter and drawing of an alarum by "Brack's Brother," but that being rather complicated, I propose one very simple and not expensive. Measure one of your clock lines with the weight attached, in order to know how much it runs down in an hour: say it does so five inches; if you want it to strike in two hours place at the distance of ten inches from the clock a flat piece of board, with a trap cut in it, so as to open downwards with a small pair of hinges. Fasten a hanging bell up high, with a string attached to it, so short as not to reach the trap. Tie a small wedge to the other end of the string, pull the string down to the trap, catch the wedge so as to hold up the trap, and when the clock weight descends to the trap it will go down, the wedge will fly up, and the bell will consequently ring. By inserting this in an early number, you will much oblige your constant reader and well-wisher,

EDMUND GREDLEY.

### DESCRIPTION OF ENGRAVING.

Fig. 1 represents the alarum while set; A is the trap, B the wedge, C the rope, D the bell, E the clock weight. Fig. 2 represents it after it has gone off; A is trap open, B the wedge after it has flown up, C the rope, D the bell in its proper position, E the clock weight, which by descending has opened the trap door.

## SAINT MONDAY.

ALTHOUGH it is undoubtedly true, as most of our readers have probably experienced, that "there are few things to be seen in London without Money," still there *are* a few, and as they may not be known to the majority of our readers, we shall have much pleasure in giving the particulars of those we are acquainted with that tend to improve the mind and refine the taste; and we are happy to say that there are several free exhibitions of this description. We introduce the subject under the title "Saint Monday," because we address ourselves to the industrious classes, who have but few opportunities, except on these occasions, of visiting such places as those we shall describe. We know that "Saint Monday" has fallen somewhat into disrepute in consequence of the manner in which many persons abuse the holiday or half-holiday, that might be made not merely a harmless useful relaxation from the labours of the week, but also a time for intellectual improvement—for the cultivation of a taste for the fine arts—and for the gratification of a most laudable desire for knowledge. Although we should be sorry to see "Saint Monday" kept merely that the workman might have an opportunity of spending his week's earnings in the course of a few hours in the gratification of a disgraceful appetite for gin and beer, yet we are sure that the majority of our readers, and workmen generally, would employ a holiday in a manner so much more becoming rational creatures that we should indeed be sorry to see our artizans so much reduced by poverty or so degraded by the love of gain, that they could not spare a few hours now and then—in the afternoon of "Saint Monday," for instance, in order to cultivate their sympathies with the beautiful in nature and art. Although as Wordsworth says,—

> One impulse from a vernal wood
> May teach you more of man,
> Of moral evil and of good,
> Than all the sages can.

Yet most assuredly next to the impulses that we receive from viewing the works of nature, are those which even the most unlettered must derive from seeing such beautiful representations of nature as those, for instance, that are preserved in our National Gallery, and in the exhibitions that are opened from time to time in the Metropolis, to which the public are admitted on payment of a small fee. It is a disgrace to a country so rich in works of art as England, that the public should be excluded from seeing them unless the visitors are so fortunately situated that they can afford to pay "the fee upon fee" that is demanded for exhibiting. We sincerely trust that the meeting lately held at Freemasons' Hall for the purpose of petitioning against the continuance of these practices will be productive of good. In France, and other continental countries, a workman when he takes a holiday can gratify his taste for the beautiful in art, without depriving himself of some little comfort that he obtains out of his weekly earnings. With the English artizan, however, it is very different; he must either pay "like a gentleman," or deprive himself of the gratification he desires.

Digitized by Google

The impolicy of allowing this state of things to continue is becoming more evident every day. It not only deprives people of an intellectual enjoyment, and induces them to have recourse to pleasures of a less moral and often positively degrading character; but it also keeps the artistical taste of our manufacturers far behind that of continential workmen. In every point of view, therefore, it is impolitic not to afford our artizans the opportunity of visiting without impediment the collections of works of art in this country; and we look to a liberal and enlightened government for the removal of the causes that prevent this taking place, and for the realization of the hopes that have been so often disappointed by "Men having authority." As we have stated, however, there are many beautiful collections of paintings and other works of art, in and about the Metropolis, to which the public are admitted gratuitously on observing certain forms, or by paying a very trifling admission-fee. These we shall proceed to describe in our next and succeeding numbers; and hope to be able to point out to our readers a variety of interesting exhibitions, where they can profitably employ a few holiday-hours occasionally, cultivating their taste at the same time perhaps that they are improving themselves for their different professions.

## STEAM BOILER EXPLOSION AT HULL.

We have received the following letter, pointing out what might be considered a mistake in No. 35, in describing the manner in which the explosion was produced. A slight typographical inaccuracy has made the passage rather ambiguous, but every person acquainted with the rudiments of Chemistry knows that a compound body can only be decomposed by some substance that has a greater affinity for one of the elements than they have for each other; this is the case with steam as with every thing else, and we are much obliged to our correspondent for his description of its decomposition, although, as will be seen by the evidence given in No. 36, scientific men appear to think that oxygen must be obtained from some other source than the atmosphere.

*To the Editor of the* Penny Mechanic.

Sir,—In the article Steam Boiler Explosion in No. 34, it is stated that the explosion took place, not from the expansion of the steam, but from the explosion of gases generated by the decomposition of the steam by the red-hot boiler, and that the gasses are the same as those used in the oxy-hydrogen microscope, viz., oxygen and hydrogen, the constituents of water. Now this seemingly good explanation is decidedly wrong, as I think the following will show. The reason why the steam is decomposed by the hot iron boiler is on account of the great affinity of the iron for the oxygen of the steam, which it separates and enters into union with, producing "oxide of iron," leaving the hydrogen *alone* in the boiler in the gaseous form; and hydrogen without oxygen will *not* explode. And it is clear that no atmospheric air which would supply oxygen, could enter the boiler, for if the valve or any other communication between the boiler and atmosphere were open, the steam would escape by that, and would effectually prevent any inward current. But supposing a small portion of air *did* enter, it would only be in small quantities, which would explode and form water with a *much smaller* portion of hydrogen. It is clear therefore that it could not arise from the explosion of gas or gasses, and if effected by gas at all, it must have been by the expansion of the hydrogen.

Yours, &c.

C. D. Thomas.

## THE KENT ZOOLOGICAL INSTITUTION,

ROSHERVILLE, NORTHFLEET.

It affords us no small degree of pleasure to be instrumental in giving publicity to new inventions or improvements which may tend to benefit any part or portion of our fellow-men, but we never feel so much at home or in our element as when we attempt to write on the merits of any undertaking which has for its object the comfort, happiness, and prosperity of the community at large; and we only regret our incapacity to set forth in more deserving terms the praiseworthy exertions of those gentlemen who, having the good, the real good of their countrymen at heart, sacrifice their time, and embark their property, in enterprises of the most beneficial character. We live in one of the most important eras in the career of time: the next ten or twenty years are big with events—such as will create a complete revolution in the system of things. A few years since—'twas in our fathers' time—a man dared not undertake a journey of fifty or sixty miles without first making his will, and going round the circle of his friends to take not unlikely a "long and last farewell," such were the contingencies attending travelling in those days. How different

Digitized by Google

now, even by stage-coaches! but what will it be when our Birmingham, our Southampton, our Bristol, our Brighton, and their various branch rail-roads are completed! why, we had nearly said, in a few hours we shall see them all! The fact is certain, that, should we live to see these railways finished, whether we travel by way of Southampton or Dover, we shall take breakfast one morning at Liverpool, and the next, at the same hour, in Paris! We shall step into Williams's, in the Old Bailey, and take lunch at two, preparatory to dining with a friend in Brighton, a little before five.

And, through the kindness of some happy-thoughted gentlemen, who have formed themselves into a Company for laying out grounds and establishing a Zoological Institution, near Gravesend, we shall take an evening promenade in their Gardens, after 'Change and Bank business is done. We have before us a prospectus issued by this Company, to which we are happy to see affixed the names of many respectable, influential, persevering men—men who have proposed, and will, we doubt not, carry into execution, this most desirable scheme, provided they have the co-operation and assistance of the public. We shall be glad at some future time to give a sketch of the plans on which their grounds will be laid out—for the present, however, we content ourselves with an extract or two from the prospectus referred to.

"The design of the Institution will comprehend a Zoological Garden, Museum, and appropriate Room for Lectures in every department of Natural History.

"The site of Ground chosen possesses the requisite properties for the Garden, which will be laid out perfectly unique, and the Buildings to contain the entire Zoological Specimens will be so constructed as to be visited at all seasons of the year.

"Measures will be adopted by which the Menagery will be enriched with the most choice subjects, both foreign and indigenous, that can be procured, in which the Committee of Management, in their zealous endeavours to promote the interests of Zoological Science, confidently trust to have the most liberal assistance from the several Socities now established.

"It may therefore fairly be presumed, that this Society will arrive at the same degree of eminence and utility as similar Establishments have in other Counties."

## SCHOOL OF DESIGN.

*To the Editor of the* PENNY MECHANIC.

SIR,—In common with every other person who desires to see a knowledge of the Fine Arts diffused as widely as possible amongst artizans and workmen of every description to whom it may prove useful in their various professions, I was highly gratified when I first learnt that Government intended devoting a sum of money for the purpose of establishing a School of Design. The utility of such an Institution must be apparent to every one who is at all acquainted with the present state of our manufactures. Continental workmen are acknowledged to be superior to our own in the art of designing, and the cause is, that the former have far greater opportunities for studying beautiful compositions and improving their tastes than we have. With but two or three exceptions every place containing any beautiful specimen of art is closed from public view, unless the visitor can afford to put his hand pretty deeply into his pocket. Besides this, what means have we for giving our workmen an elementary knowledge of perspective, or the principles of design? With the exception of a few classes at some of the Mechanics' Institutions, I know of none. The establishment of a School, therefore, where these things should be taught to young men, and where they could be prepared to enter upon their profession in the possession of knowledge not merely calculated to advance their own interests, but generally to improve the manufactures of the country, was indeed an object much to be desired. To accomplish it not merely fifteen hundred pounds, but fifteen thousand would not have been too much, but with the former sum alone much good might have been accomplished with judicious management. If, however, the School of Design is really to be formed according to the prospectus that has lately been issued, is there the slightest prospect of its being successful? The subscription is to be four shillings per week! a larger sum than the greater number of those for whom the school is to be professedly established, can afford to expend upon wearing apparel! Why, a number of young men subscribing together could have attained efficient masters, and, in time, a good collection of specimens at a much cheaper rate. Four shillings *per month* (double the subscription to the London Mechanics' Institution, where there are good drawing and modelling classes) would have been more reasonable than the sum *per week*, and the subscription must be greatly reduced indeed before working men can avail themselves of the advantages of the School. But there is another no less objectional pro-

Digitized by Google

vision; the rooms are only to be opened from ten till four o'clock. Really this regulation is so utterly inconsistent with any thing we might anticipate, that we cannot help asking, Who is this School intended for? Not, certainly, for those for whose benefit it is said to be instituted. Who can attend during the day excepting young artists who intend to follow up the study professionally? It appears to me that the object of Parliament in granting the money has been entirely overlooked, and if the young artizans of the Metropolis wish to obtain any benefit, they should at once present a petition to the House of Commons upon the subject.

I am, Sir, Yours respectfully,

N. S. N.

[From the prospectus that has been issued, it appears that the School *is* intended for young artists only. A School for working men, at a reduced rate of subscription, will be opened shortly; this will be held in the evening. Ed. P. M.]

## LIST OF PATENTS.

### ENGLISH.—MACHINERY.

*Berry, Miles*, Chancery-lane, Middlesex, for an improvement in obtaining motive power for propelling or working machinery. For six months, from 6th June.

*Blake, James Partridge*, Little Queen-street, Middlesex, for improvements in preparing rice, paddy, oats, and such other grain. For six months, from 30th May.

*Bodmer, John George*, Bolton Le Moors, Lancaster, for improvements in machinery for spinning and doubling cotton, wool, flax, &c. For six months, from 12th June.

*Buckingham, James*, Great Randolph-street, Camden Town, Middlesex, for improved combinations of machinery, to be applied where tooth gear and other mechanism have hitherto been used. For six months, from 17th June.

*Cook William Fothergill*, Hastings, Sussex, and *Charles Wheatstone*, of Hanover Square, Middlesex, for improvements in giving signals and sounding alarums at distant places by means of electric currents transmitted through metallic circuits. For six months, from June.

*Dansill, Joseph Choild*, Limpley Stoke, Wilts, for improvements in stone machinery. For six months, from 6th June.

*Gerish, Francis William*, East-road, City-road, Middlesex, for apparatus for closing doors, shutters, &c. For six months, from 30th May.

*Millet, Richard Oke*, Peupalls, Hayle, Cornwall, for improvements in instruments for extracting teeth. For six months, from 1st June.

*Nash, Theophilus John*, John-street, Downshire-hill, Hampstead, and *John Ross*, of Wild-street, Lincoln's Inn Fields, Middlesex, for an improved method of making (in wood and metals) letters, figures, and other devices, which having a flat surface, present by the aid of colours the appearance of projection and doomed letters, &c. For two months, from 19th June.

*Nicholson, William*, Manchester, for improvements in spinning machinery. For six months, from 17th June.

*Roe, Richard*, Everton, near Bawtry, York, for an improved machinery for making bricks. For six months, from 17th June.

*Thomas, James Leonard Clement*, Covent-Garden, Middlesex, for improvements in steam engines, and steam generators to save fuel. For six months, from 17th June.

*Woolams, Joseph*, Wells, Somerset, for improved methods of obtaining power and motion from known sources. For six months, from 30th May.

*Woone, Godfrey*, Berkely-square, Middlesex, for an improved method of forming plates with raised surfaces for printing impressions on different substances. For six months, from 12th June.

*Yetts, William*, Yarmouth, for an improved mode of caulking ships. For two months, from 19th June.

### CHEMISTRY.

*Kirkman, John*, St. Pancras-road, Middlesex, for an improved mode of removing carbonaceous incrustation from the internal surfaces of retorts employed in generating gas. For six months, from 8th June.

*Swaine, Edward Schmidt*, of Leeds, for a method of producing and preserving artificial mineral waters, and for machinery to effect same. For seven years, from 9th October next.

## PATENTS FOR SCOTLAND.

### MACHINERY.

*Adams, William Bridges*, Porchester-terrace, Bayswater, for improvements in wheel carriages. 2nd June.

Digitized by Google

*Debac, Pierre Bartlemy Guinebert*, Brixton, Surrey, for improvements in railroads. 12th June.

*Guynemer, Charles*, Manchester-street, Manchester-square, for improvements in piano-fortes. 24th May.

*Livsey, Joel*, Bury, Lancaster, for improved machinery for spinning cotton, &c. 21st June.

CHEMISTRY.

*Crawford, William Henry*, for preventing oxydation of iron, copper, &c., by an improved coating. 22nd May.

*Gossage, William*, Stoke Prior, Worcester, for an improved apparatus for decomposing common salt, and condensing the product. 2nd June.

*Sheridan, John Joseph Charles*, for improvements in the processes of the saccharine, vinous, and acetous fermentations.

## MISCELLANIES.

*To Brew a Gallon of Ginger-Beer.*—Two pounds of the best refined lump sugar, a couple of fresh lemons finely sliced, two ounces of the best fresh powdered ginger, and a desert spoonful of cream of tartar, are to be put into a gallon of fine soft water. Let the whole simmer for an hour over a gentle fire, taking care not to let it boil. Pour off the clear liquor, let it stand till cool, add a table spoonfull of porter yeast, milk warm, let the whole repose twenty-four hours, scum off the top, strain the liquor through a flannel bag, and bottle it up. By varying the proportions of the ingredients, the beer can be made hotter, sweeter, or more acidulous, according to the brewer's taste.

*The Steam Plough.*—The machine and auxilaries remain stationary during the time occupied by the ploughs in taking one furrow; they are then severally put in motion, and made to advance in three parallel lines, in order to keep pace with the breadth of land turned over, and to pull the ploughs accurately straight. The machine is impelled by the engines, and each auxiliary by its attendant man, who also shifts his plank onward as occasion requires. The machine and its auxiliaries have thus to be moved over a space of eighteen inches only, whilst the ploughs have each travelled 220 yards, and turned over 220 square yards of land nine inches in depth; in other words, the machine and auxiliaries have only to be moved eleven yards, in the time that the ploughs have travelled five-and-a-half miles, and turned over a statute acre of land. The ploughs perform their work at the rate of two miles an hour, and are subject to very few stoppages; so that eight acres and three quarters nearly of bog would be ploughed up in a day's work of twelve hours; or, taking the average of daylight throughout the year, and making a liberal allowance for hinderances from weather and other causes, one machine would plough up 2,000 acres in a twelvemonth. The principal machine, together with a six ton load of fuel, weighs about thirty tons, its superficial bearing on the moss is 399 square feet, giving a pressure of 178lb. on each square foot. Taking the weight of a man at 168lb., and the area of his foot at thirty square inches, he would, in walking, press with a weight at the rate of 806lb. per square foot, so that the machine has a buoyant of about four and three-quarters times that of a man, and could therefore travel on much softer soil than red moss, which is considered very wet and spongy.—*Journal of Agriculture.*

*Friction in Tubes*—At a late meeting of the Institution of Civil Engineers, a paper by Mr. Horne, descriptive of a mode which has been adopted successfully for ventilating a mine by forcing in air, was read. The pipes were five inches in diameter, and extended a mile; and the ventilation produced was complete. A discussion then took place on the friction of air and gas passing through pipes of different lengths and diameters. It was stated that the loss on forcing gas through 1000 feet of pipe, amounted to 75 per cent.; that is, if 100 cubic feet of gas are delivered through an aperture under a given pressure, only 25 cubic feet will be delivered through a pipe 1000 feet long, under the same pressure.

## INSTITUTIONS.

*Verulam Philosophical Society of London.*—On Wednesday, the 14th of June, the members and their friends dined together at the Ship Tavern, Water Lane; in order to commemorate the Birthday of their Founder and President, Professor Dewhurst; Henry Braddon Esq, of Emmanuel College, Cambridge, presided; and Dr. Brown, F.R.S.F., occupied the Vice Chair, on which occasion a splendid medal, executed by Mr. Shaw, of Gough-Square was presented to Professor Dewhurst bearing beneath his Armorial Bearings the following inscription.

To Henry William Dewhurst, Esq, Fellow of many learned Societies in England, Ireland, and America, &c. Professor of Astronomy, Anatomy, &c. this medal

Digitized by Google

was presented to him as Founder, President, and Director, by the Patron, Vice President, Council and members of this society as a small token of their esteem and admiration of his private worth, his brilliant talents, and great exertions in the diffusion of Literary and Scientific Information among all classes of society.—Fourth Session 1836-37.

On the same evening the first Braddonian silver medal was presented by Mr. J. K. Hunt, for the best Essay on the formation of minerals, by the learned chairman, who announced the following subject for competition; the prize to be also a splendid Silver Medal—"Does Geology prove the Earth to have been originally of a fluid origin: if so, upon what evidance?" All Essays to be sent in on or before December 1, 1837, (post paid) to the President, Professor Dewhurst, Verulam Cottage, Pentonville.

JOS. DRAN,
*June* 21, 1837. Hon. Secretary.
*Vineyard Walk, Clerkenwell.*

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, July 12, Basil Montague, Esq., on the Patriot and the Demagogue.—Friday, 14, Professor Calvert, on Elocution and the art of Reading, at half-past eight.

*Eastern Athenæum.*—Wednesday, July 12, J. Dunn, Esq., on Meteorology, at eight o'clock.

*Poplar Institution*, East India Road.—Tuesday, July 11, Robert Bindley, Esq., on the Theory and Practice of Naval Architecture, being the second of a course of lectures on Naval Architecture and the causes of Shipwreck, at eight.

*Gower Street Institution*, Cafe Colloseum, New-road, Monday, July 11, Mr. J. J. Hawkins, on the art of Lecturing, at eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, July 12, Colonel Thompson, M. P. on Political Economy,—the Currency, at half-past eight.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Kite Carriages.*—Sir,—Can you tell me what sort of wood and what sort of calico I should use for making a kite for a carriage, and the way of managing the reins.

[Our Correspondent will find full particulars in the little book published by the inventor, and which may be obtained of Mr. Doudney our printer. We cannot answer the query at length in the Magazine.—ED. P. M.

*Gilding Picture Frames.*—Will you, or some of your correspondents, be kind enough to tell me how to regild picture frames; an early answer to this query will much oblige,

A well-wisher to your
Useful Magazine, G. S. H.

*Linseed Oil.*—Sir,—you will much oblige me if you, or any of your correspondents, could inform me how to purify linseed and other oils.

I remain your constant reader,
AMATOR SCIENTÆ,

ANSWERS TO QUERIES.

*Coloured Fires.*—Sir,—I beg to inform "A. B. Y. L." that the best fires are made in the following manner:—

*Red Fire.*—Forty parts of dry nitrate of strontia, which is sold in crystals containing water which may be expelled by putting them on the hob of a moderate fire for half an hour, thirteen parts of flowers of sulphur, five of chlorate of potash, four of sulphuret of antimony, and a little powdered charcoal; the ingredients should be separately powdered and mixed afterwards.

*Blue Fire.*—Sixteen parts of saltpetre, four of sulphur, and one of orpiment, and a little powdered charcoal.

*Green Fire.*—Sixteen parts of meal powder, three of copper filings, and a little charcoal. If the above is of any service to "A. B. Y. Z." he is welcome, and the insertion will oblige

Your Friend. ZAMIEL.

*To make Fusible Alloy.*—Sir, permit me, through the medium of your Magazine, to answer "J. D.'s" queries in your last number, how to make Fusible Alloy. Heat in a crucible four ounces of bismuth, two ounces of tin, and two ounces of lead, then add one ounce of mercury; the compound becomes fluid at 170°.

P.S.—I believe the above Alloy melts at a less heat than Parke's.

*To make Blue Signal Lights:*—Six ounces of saltpetre, two ounces of sulphur, and one ounce of sulphuret of antimony. When a lighted match is applied to this mixture a brilliant deflagration takes place: it can be seen at the distance of fifty miles.

Yours respectfully,
E. CAMPBELL.

## TO CORRESPONDENTS.

Mr. Cary, Shepton Mallet. *The drawing and description of a* new Coach Drag *shall appear in an early number.*

M. V. *The letter shall be translated and published.*

Frank. *Try æther. We have always found naptha do very well. In several of our back numbers there are communications on the subject to which he had better refer.*

Mr. Douglas. *The petition to the House of Commons respecting* Accidents in Mines *shall appear.*

*We shall have a word or two to say respecting the letter of* W. H.

M. N. *We shall be happy to receive the model, and when the description is published, will introduce the invention to the notice of some gentlemen who may probably be inclined to patronize it.*

*The letter on* Railway Tunnels *is too long; we will, however, endeavour to find room for it.*

Amator Scientæ *We do not remember the circumstance, but will refer to the subject, and if necessary, give a further explanation.*

*We have been obliged to postpone the letter from* Amicus *till next week.*

*Received several* Queries *and* Answers.

*The description of* Davenport's Electro-magnetic Engine *shall appear in an early number.*

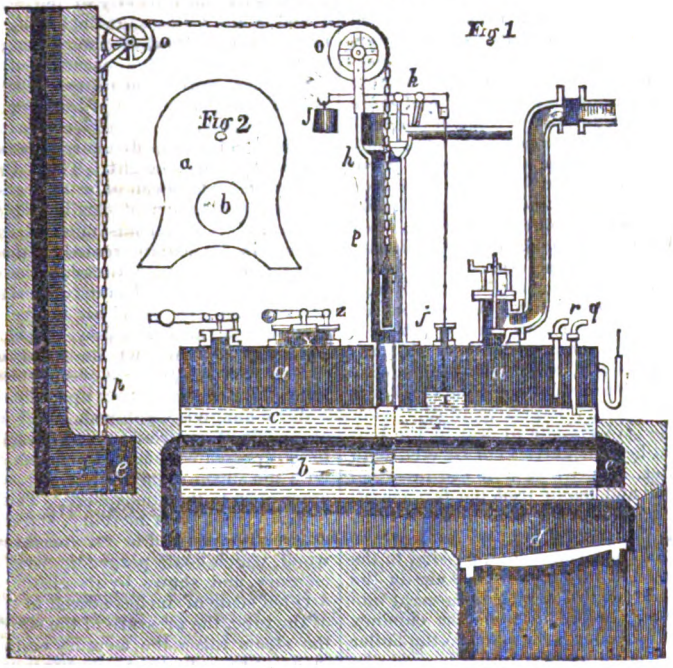
London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

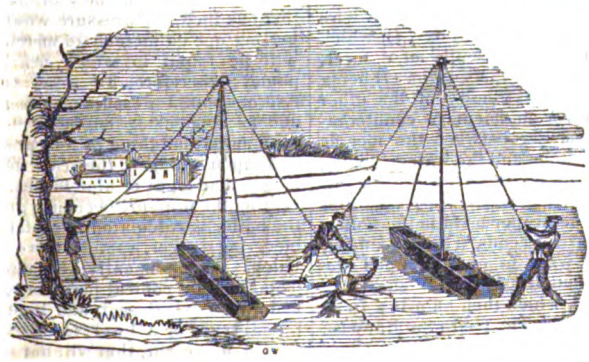
# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. XXXVIII.] SATURDAY, JULY 15, 1837. Vol. I.


### STEAM BOILERS.




### APPARATUS FOR RESCUING DROWNING PERSONS FROM THE ICE.




Vol. I.—No. XXXVIII. Holloway Press: D. A. Doudney.



Digitized by Google

## STEAM BOILERS.

The earliest boilers employed for generating steam, and applied as a motive force, with which we are acquainted, were either globular or hemispherical, with flat or concave bottoms; and many of these are still in use for the supply of high-pressure engines. In situations where fuel is so abundant as to render needless any economy of it, they may continue to be used with advantage, as their form adapts them to withstand steam of great elastic force. The waste of fuel caused by them, elsewhere, led to a very general substitution of boilers of an oblong form; and those known by the term of "waggon boilers," from their shape, formed one of the many improvements of the steam-engine introduced by Watt. A longitudinal section of a boiler of this kind is represented by Fig. 1 in the subjoined engraving, fitted up with all the appendages now generally applied, and set in a furnace of the usual construction. *a a a* is the boiler, having a cylindrical return flue (*b*) throughout its length; the form of these parts will be best understood by considering them with reference to Fig. 2, which shows the figure of the boiler in its cross section (*b*), being the return flue; this portion of the boiler should be always placed near to the bottom, and be constantly kept covered with the water, as seen at *c* in the drawing. The flame and smoke from the furnace (*d*) first passes under the boiler, then returns through the flue (*b*) to the front, where the current is divided, and, passing to the right and left through lateral flues in the brickwork (one of which is brought into view at *e e*) before it enters the chimney (*f f*). The water is supplied to the boiler by the feed-pipe (*g*), which is made to contain a column of water equal to the amount of pressure in the boiler. On the top of this pipe is a cistern (*h*); *i* is a float, made of stone, suspended by a wire passing through a stuffing-box (*j*), which is attached to one extremity of a lever, whose fulcrum is at *k*, a weight (*l*) being suspended to the extremity of the other arm of the lever sufficient to counterbalance the difference between the specific gravity of the stone and the water, causing the former to lie on the surface of the latter. By this arrangement, when the water sinks below the proper level in the boiler, the stone float descends with it, causing the attached wire to operate upon the lever above, and lift the valve shown in the cistern (*h*), which then affords a fresh supply of water. The feed-pipe likewise contains an iron bucket, hung by a chain that passes over two pulleys (*o o*); the other end is attached to a plate of iron (*p*) called the damper, which is used to enlarge or contract, and, when required, entirely close the throat of the chimney. By this contrivance, when the steam in the boiler is urged to too great an extent, its pressure forces the water in the feed-pipe upwards, thereby raising the bucket (*m*), and causing its counterbalance, the damper, to descend in the throat of the chimney, and reduce the intensity of the fire. At *q* and *r* are two guage-cocks, by which the proper height of the water in the boiler may be always ascertained. If *q* discharges water, and *r* steam, the water is at the proper height; if both cocks discharge water, it is above its proper height; and if both discharge steam, it is below its proper height. This latter circumstance, which can only take place by the defective action of this last-described apparatus, is of serious moment, and requires an immediate remedy; the most safe is, in our opinion, the reduction of the fire, by stopping up, by the readiest means at hand, all access of air to the grate, after which, attention may be paid with confidence to removing the cause of the defect. For the purpose of showing at all times the pressure acting upon the boiler, a steam-guage is employed. This is usually made of an iron tube, bent into the form represented, one end communicating with the steam-room of the boiler, and the other open to the atmosphere. This tube is partly filled with mercury, and into the externally-open end is put a slight rod of wood, which floats perpendicularly in the mercury, and shows by its altitude, on a divided scale of inches affixed to that leg of the tube, the pressure of the steam. If the steam raises the mercury or rod one inch, it proves that the pressure is one half pound per square inch on the internal surface of the boiler, tending to burst it; for if the section of the bore of the pipe was just one inch, the pressure would be supporting one cubic inch of mercury, which will be found to weigh nearly half a pound; therefore, for every two inches rise, one pound pressure may be reckoned; and as condensing engines seldom work with more than three or four pounds pressure upon the inch, the scale need not be longer than eight or nine inches. For preventing the pressure becoming greater than the boiler is calculated to sustain without incurring danger, a safety-valve (*u*) is provided. This is usually a circular piece of metal, with a conical periphery ground to fit into a conical seat, and kept there by the pressure of a lever, loaded with a determinate weight, that will not suffer it to rise until the steam has acquired an excess of force above that required for work-

Digitized by Google

ing the engine, or would endanger the bursting of the boiler. In large boilers, especially those in steam-boats, it is usual to have another safety-valve, inclosed in a box under lock, the key being kept by the chief manager, to prevent the possibility of improper interference with it, by ignorant or imprudent persons: by the neglect of which precaution many serious accidents have occurred. The steam which escapes from safety-valves is generally conducted by a pipe from the valve boxes into the chimney. At *v v* is the steam-pipe by which the engine is supplied, the quantity being regulated by a throttle-valve at *w*, and a screw-down valve at *x*. For the purpose of cleaning out or examining the condition of the boiler, a circular or oval hole (*y*) is made sufficiently large to admit a man to pass through, and therefore called the man-hole. It is covered by a strong plate of iron bolted down, in which plate is usually fitted the atmospheric or vacuum safety-valve (*z*), which opens inwards by the pressure of the atmosphere, preventing the latter force from injuring the boiler, should a vacuum be formed by condensation within. A cock and pipe leading from the bottom of the boiler is employed for discharging it of its contents. The above description is taken from the Engineers' Encyclopœdia.

## APPARATUS FOR RESCUING DROWNING PERSONS FROM THE ICE.

*To the Editor of the* PENNY MECHANIC.

SIR,—In Number 36 of your Magazine, I perceive you have inserted a letter from a Correspondent who signs himself G. P. P. In this letter he notices my invention for saving drowning persons in the ice; but conceives the machinery to be imperfect, in consequence of its being only applicable to those who still retain sufficient strength to assist themselves, by placing the rope round their bodies. I think, Sir, my diagram given in page 27 is not properly understood, or perhaps my description was not so explicit as it ought to have been, otherwise G. P. P. would have seen I had provided for the assistance of those too far spent to help themselves.

The two flat-bottomed boats there given are placed on each side the water; with sufficient running tackle to allow a man to be drawn from either side of the river to the other. When a person has fallen in the ice, and is so far spent as not to be able to help himself, any one volunteering can be placed in the noose and carried off to the sufferer with the greatest ease and safety: he is then let down sufficiently low to seize hold of him, and placing a second noose round his body, they are both drawn up and borne off to the shore.

I have enclosed another diagram which, if you think worth inserting, you will oblige Your humble servant,

H. P.

## LONDON MECHANICS' INSTITUTION.

*To the Editor of the Penny Mechanic.*

SIR,—As a member of the London Mechanics' Institution, Southampton-buildings, Chancery-lane, I venture through the medium of your Magazine, to call the attention of the senior members of that Institution to the important motion that was adjourned from Wednesday the 7th June, (the quarterly meeting night), until the 26th of July inst.; the principle of which motion is, that all youths who shall hereafter join the Institution, being under 18 years of age, shall not be entitled to speak or vote at any of the meetings or elections in the Institution; and that no member shall be eligible to serve as a Committee-man until he has attained the age of 21 years.

I should not have taken this step but for the conduct of those few persons who, on the 7th inst. opposed the motion, and who perceiving that the great majority of the members then present were favourable to the proposed motion, conducted themselves in the most noisy, and unbecoming manner, and by continued motions for adjournment, succeeded at length in postponing the decision of the question, hoping thereby to obtain a majority against the motion at the adjourned meeting, it being well known that adjourned quarterly meetings are usually only attended by mere boys.

It is for the express purpose of frustrating such an improper attempt, that I now write thus earnestly to solicit the attendance of all those members who, from their mature age and experience, will be enabled to judge of the real merits of the question. Although I do not intend to enter into the subject to be discussed on the 26th instant, it appears to me to be so self-evident that it will be highly beneficial to the real interests of the members of the Institution that the adjourned motion should be carried; that I am anxious by every means in my power to ensure as full an attendance at the meeting as possible.

Entertaining this strong opinion, I beg to impress upon the minds of those persons who are really anxious for the

Digitized by Google

welfare of this Institution, the importance of attending the adjourned meeting on the 26th instant; and I wish also to impress them with the importance of attending (as much as possible) at all the quarterly general meetings of the Institution, the proceedings of which of late have been (owing to the absence of the majority of the senior members) far from satisfactory.

At the last three or four quarterly meetings there has been little else but a continued uproar; and through the agency of the juvenile members (led on as they are by a few persons whose simultaneous desire seems to be to create dissatisfaction and jealousy against the management of the Institution) measures have been passed which will, I fear, eventually prove very detrimental to the Institution. It is well known that out of about 1200 members, not more than 200 ever take any part in the elections for officers, or attend any of the meetings of the Institution, and of those a very considerable number are mere boys, who, from their extreme youth are wholly incapable of exercising a sound judgment on the different questions that come before them. Uniting, however, as they do with the persons I have before alluded to, they possess by their mere numerical force (and through the neglect of the members of more mature age) an influence in the elections and affairs of the Institution far beyond their real merit, and such an one, as if not checked, will ultimately throw the whole management into their hands.

It is the duty of *every* member of a public institution to lend the utmost aid in his power to maintain and preserve the true interests of any society to which he may belong; and not by his neglect allow its welfare to be trampled upon, its laws set at defiance, and the whole reduced to one chaos. Hoping this appeal will arouse the dormant energies of those to whom it is addressed,

I am, Sir,
Your Obedient Servant,
AMICUS.

[We have an objection to insert anonymous communications except on subjects of a perfectly neutral character; but the writer of the above having favoured us with his name, and stated why he does not wish it to be published; and as we know him to be a gentleman on whose statements we can depend, we do not object to the insertion of his letter. We must act differently, however, with another that we have received from an anonymous correspondent, charging certain members of the Institution by name with attempting tyrannically to deprive the younger members of their privileges. The least that the writer could have done was to authenticate such a letter by annexing his name. But even then we should have declined to insert the communication. We stated at the first that we should always endeavour to prevent our work becoming a cause of unnecessary vexation to any party, and we shall carefully avoid taking a part in the squabbles of any institution which can only interest a small portion of our readers, and had much better be kept from the public eye. —ED. P. M.]

## THE MARQUIS OF WORCESTER AND DE CAUS.

*To the Editor of the Penny Mechanic.*

SIR,—I don't know if you are acquainted with the following fact. Ninon de l'Enclos wrote to the Marquis d'Effiat, that visiting Bicêtre with the Marquis of Worcester, they saw a man grappling the iron bars of his cell, and speaking with great vivacity. The warden told them that the name of the man was Solomon de Caus, who, in his madness, thought he could employ water exposed to a high temperature, instead of the power of men and horses; he wrote a book filled with absurdities, and sent it to the king; and that his madness being sufficiently proved, he was confined in the madhouse. The Marquis, continued Ninon, listened to this man during a long time, and came back all pensive, and was not satisfied till he had got the madman's book. Thus the English Marquis was wiser than my countrymen, and found in the book of Solomon de Caus the ideas he claimed as his own.

The book of Solomon de Caus was published in 1615, under the title of "Raison des forces mouvantes, arec diverses Machine tant utiles qú agréables."

If you wish to have a copy of the interesting letter of Ninon de l'Enclos, I will send it to you immediately, in French.

I remain, Sir, yours, &c.
M. J.—a Frenchman,
May, 1837. And Constant Reader.

TRANSLATION.

Letter from Ninon d'Enclos to Cingmars, to whom she was secretly married.

3rd Feb., 1641.

MY DEAR D'EFFIAT,—Whilst you are forgetting me at Narbonne, amidst the gaities of the court, and the pleasure of thwarting the Lord Cardinal, in compliance with the

Digitized by Google

wish you expressed, I have been doing the honours of Paris to your English nobleman, the Marquis of Worcester, and I take him, or rather he takes me, from one curiosity to another, choosing always the most serious, speaking little, listening with extreme attention, and fixing on those whom he interrogates two large blue eyes, which seem to pierce to the bottom of the soul. Moreover, he is never satisfied with the explanations that are given him, and hardly ever views things in the light in which they are placed before him. Witness the visit that we paid to Bicètre, where he pretends to have discovered in a lunatic a man of genius. Had he not been in a state of raving madness, I believe he would have requested his liberty, in order that he might take him to London, and listen to his follies from morning to night.

As we were crossing the lunatics'-court, and whilst—more dead than alive—I pressed close to my companion in alarm, a hideous face showed itself behind a large grating, and began crying out in a broken voice, "I am not mad—I have made a discovery that will enrich the country which puts it in execution." "And what was his discovery?" I inquired of the guide who was showing us the establishment. "Ah!" said he, shrugging his shoulders, "something that you would never guess; it is to make use of the vapour of boiling water." I began to laugh. "This man," continued the keeper, "is named Solomon de Caus; he came from Normandy, four years ago, to present to the king a memorial on the wonderful effects that his invention was capable of producing. He asserts that with steam we might turn mills, propel carriages, and I know not what besides, with a thousand similar wonders. The lord cardinal sent away this lunatic, without listening to him. Solomon de Caus, instead of being discouraged, assiduously renewed his applications, till his highness, wearied by his importunity, and vexed at his follies, ordered that he should be confined at Bicètre, where he has been for three years and a half; and, as you have yourself seen, he calls out to every stranger that he is not mad, and that he has made an admirable discovery. He has composed a work* on the subject, which I have here." The Marquis of Worcester, who had become quite thoughtful, asked to see the book, and, after having read a few pages, said, "This man is not mad, and in my country, instead of being put in prison, he would have made his fortune. Take me to him—I wish to question him." This request was complied with, but he returned sad and pensive. "Now he is indeed mad," said he; "misfortune and captivity have for ever deprived him of reason; you have made him mad: but when you threw him into this dungeon, you confined the greatest genius of your time." He then left the place, and ever since he has spoken of nothing but Solomon de Caus.—Adieu, &c.

* The work of Solomon de Caus is entitled, "The Theory of Moving Forces with divers Machines, equally useful and amusing," and was published in 1615.

## THE HUMAN BODY.

### DIGESTON—3rd ARTICLE.

THE most important chemical change that is effected in the food, previous to its being assimilated to the structure of the body, takes place in the stomach. This organ is situated on the left side, a little below the apex of the heart; when distended it is capable of holding about three pints, and in appearence is something like a bladder but it has two openings, and is larger at one end than the other. It is plentifully supplied with blood vessels and nerves; and in consequence of the latter being sent from different parts of the body, the stomach sympathises with any injury these parts may sustain. The celebrated Hunter called it the centre of sympathy; and Aberneathy affirmed that a man could not cut his finger without disturbing to a certain extent the function of digestion! We are all aware that it does exercise a very considerable influence over the other organs of the body and the functions they perform. The man who indulges in the pleasures of the table too freely over night receives a due admonition the next morning from his aching head and parched throat, not to commit a similar folly again, and when the digestive organs are suffered to become permanently deranged; when confirmed indigestion ensues it occasions by far the greater portion of all the "ills that flesh is heir to." The inner lining or coat of the stomach is exquisitely sensible; this occasions its being frequently deranged. Infants very often die when from any circumstance they are deprived of their natural food, the *milk*, in consequence of the stomach refusing to digest aliment of a different description; and when poisons are introduced into the stomach vomiting is generally produced in consequence of the great sensibility of the structure of which we are speaking. The digestion of food is a chemical process. A certain fluid called the

Digitized by Google

gastric juice is secreted by the stomach, and this fluid possesses the singular property of being able to digest or soften and form into a semifluid mass every thing that is exposed to its action in the stomach. For a long time digestion was very imperfectly understood, or rather it was not understood at all. It was observed on killing animals, a certain time after they had taken food, that a very evident change had been effected in it, but how this was produced the Physiologists of the time were wholly unable to explain; some thought it was by the pressure of the muscles of the stomach; and although they are weak and small, compared with those of the limbs, yet one philosopher demonstrated, as he thought, on mathematical principles, that these little muscles could contract with a force quite equal to 15,000lbs, and as this force was sufficient to crush anything that could be introduced into the stomach, he attributed the digestion of the food to pressure alone. This opinion was however soon proved erroneous, because it was observed that the skins of fruit, husks, of corn, &c., passed through the stomach quite unchanged, and this too when food of other kinds was perfectly dissolved. If the process was effected by muscular action alone this of course would not have been the case—all substances would have been crushed or digested alike. Another class of Physiologists compared the process of digestion to that of putrefaction, but there is no resemblance between them, unless indeed they are both chemical changes. The food however does not putrify in the stomach; the gastric juice produces an opposite effect—it stops putrefaction. Meat in a state of decomposition when introduced into the stomach of a dog was found in a short time to have become quite fresh, and it is found that this effect is invarably produced in the food of birds and animals that feed on carrion. It would be tiresome to the reader to have a description of the many theories that have been proposed at different times to account for the remarkable process we are describing; we shall therefore at once proceed to state what is at present known on the subject, without troubling him with by-gone theories and exploded doctrines. Within a short time after the food enters the stomach it is subjected to the action of the gastric juice—the powerful solvent fluid that we have just spoken of—and from a number of experiments made on rabbits and other animals, the manner in which the food is acted upon appears to be as follows: the food is kept in contact with the sides of the stomach by means of the muscles belonging to it, and absorbs a certain quantity of the gastric juice; in about an hour the outer portion of the mass is observed to become gelatinous; it becomes gradually more liquid and ultimately accumulates at the end of the stomach opening into the intestines: the food in this state is called chyme "it is a pultaceous and almost fluid substance of a greyish colour and acid taste, reddening paper coloured with turnsole; it is commonly said to be perfectly homogeneous in its nature; and that whatever be the species of food, the resulting mass is uniformly the same, never exhibiting any of the sensible properties of the crude alimentary matter. But this statement is not corrrect; for we learn by actual experiment that chyme produced from vegetable differs in colour, in consistence, and in some other sensible properties from that procured from animal substance. From a variety of interesting experiments by Dr. Wilson Philip we learn also that the digestion of food always takes place from the circumference to the centre, and that on the outside, and touching the coats of the stomach, is always digested before that in the centre of the mass. Fresh food is never mixed with that which has been in the stomach some time, it always passes to the centre of the mass; for the food does not mix indiscriminately, as we might at first be led to suppose. It might be naturally imagined that a fluid capable of digesting such a variety of substances of those which we partake of must be of a very powerful description; that it might be some strong acid, for instance, or possess some other remarkable property: strange to say, however, this wonderful fluid that is capable of digesting every thing, is almost tasteless; it has been procured from living animals and from some recently killed, and in all cases it was found to possess no remarkable property by which we might be led to imagine that is was capable of performing such wonderful changes as those which we know are produced by it. To the taste it more resembles salivia than any thing else and it is in appearance very much like it, or gum water. We must however reserve a description of its more remarkable properties for another paper.

---

*British Association for the Advancement of Science.*—The next meeting of this Association will be held at Liverpool. The proceedings will commence on Monday, September 11, and continue during the week.

Digitized by Google

# THE CHEMIST.

We intend for the future to devote a portion of the PENNY MECHANIC to the science of Chemistry. We should have done this long since, but considering that only a limited space could be spared for the subject, if we did justice to the contributions of our correspondents on mechanical science, we thought it would perhaps be better to publish a separate work devoted entirely to Chemistry. Upon consideration, however, we have reason to believe that it will be better to introduce the subject in the PENNY MECHANIC. It is one of such great extent, that many of our readers may probably be inclined to think we shall hardly be able to afford sufficient space to treat it properly; but the plan we propose to adopt will, we think, allow us to do so, without infringing much upon the usual contents of the work.

We shall endeavour to make "THE CHEMIST" interesting to all our readers. There are many who, being entirely unacquainted with the science, will desire to have information given them on elementary principles: this we shall endeavour to give as concisely and clearly as possible. There are many of our readers, however, who would rather desire to know what discoveries are made from time to time; how the various processes in Chemistry may be most simply and economically performed; what fresh applications of the science to the arts are proposed; and, in short, to be informed generally of the progress of the science. These things we shall also endeavour to bring before our readers in a satisfactory manner; and we have no doubt the papers we shall give will prove equally interesting to those who have made some advances in the science, and desire to know rather what is doing, rather than what has been done, as they will to those who wish to commence the study, and are at present quite ignorant of its principles. Indeed, it will be evident that a Magazine must devote itself principally to the former class of persons, if it wishes to extend its sphere of usefulness as wide as poss ble. There are such a variety of elementary works now published, and at so cheap a rate, that every person may become the possessor of one or more; but the journals that record the progress of Chemical Science are few, and very dear. *There is indeed at present no cheap chemical publication* —not one that has for its object what we propose to accomplish. Yet who will deny that it is of the greatest importance that the working man should possess the means of obtaining a knowledge of what is going forward in the scientific world. New and more economical methods of performing different processes in the arts are frequently discovered, but their utility remains unknown to a great majority of those who might take advantage of the discoveries, in consequence of the scientific works in which they are made public, being very expensive, and consequently limited in circulation. We think there are very few of our readers who will object to our devoting a portion of the Magazine for the purpose of remedying this as much as possible. By publishing queries, and we hope good answers by correspondents; by making the PENNY MECHANIC a vehicle for communications of this nature, and by carefully collecting information likely to prove useful to our readers, relating to the progress of Chemical Science, we hope to supply a want that has long been felt, but which we are sure, by the assistance of our Correspondents, we shall be able to supply a certain extent, if not completely.

To such of our readers as are at present entirely unacquainted with Chemistry, we have a few words to offer. We shall not dwell on the pleasures that attend the study, because they can only be properly appreciated by those who endeavour to obtain them. And dissertations on the advantages to be derived from the study of any particular subject, unless addressed to those who have a pecuniary interest in the matter, are generally of very little use. But a knowledge of the principles of this science may be obtained with so little trouble; the experiments are so pleasing; and the knowledge so useful to every man, in every sphere of life, that we feel sure the study will be prosecuted with earnestness and with advantage. Dr. Henry has very truly remarked, that the possession of the general principles of Chemistry enables us to understand the mutual relation of a great variety of events, that form a part of the established course of nature. It unfolds the most sublime views of the beauty and harmony of the universe, and develops a plan of vast extent and of uninterrupted order, which could have been conceived only by perfect wisdom, and executed by unbounded power. By withdrawing the mind, also, from pursuits and amusements that excite the imagination, its investigation may tend, in common with the rest of the physical sciences, to the improvement of our intellectual and moral habits; to strengthen the faculty of patient and accurate thinking; and to substitute placid trains of feeling for those which are too apt to be awakened by the contending interests of men in society, or the imperfect government of our own passions.

Digitized by Google

*Greenwich Railway.*—It appears from a statement that has been issued by the directors, that to complete the whole line to Greenwich it will require 80,000*l.*; that a dividend will shortly be declared out of the net profits of the Company, which, by the end of this month, it is expected will amount to 25,000*l.*; and after deducting for expenses 10,000*l.* for the half year, will pay a dividend on the old shares of upwards of five per cent. per annum.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, July 19, Basil Montague, Esq., on Government.—Friday, 21, Professor Calvert, on Elocution and the art of Reading, at half-past eight.

*Eastern Athenæum*, Stepney-green.—Wednesday, July 19, no lecture.

*Poplar Institution*, East India Road.—Tuesday, July 18, Robert Bindley, Esq., on Naval Architecture, and the cause of Shipwreck, at eight.

*Gower Street Institution*, Cafe Colloseum, New-road, Monday, July 18, Mr. Dalton, on Animal Physiology, at eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, July 18. Mr. Collis, on the Atmosphere, at half-past eight.

*Bermondsey Mutual Instruction Society*, British School-room, Great George-street.—Wednesday, July 19, Mr. Newton, on Poetry, at a quarter past eight o'clock.

*Milton Street Institution.*—Monday, June 18, Professor Dewhurst, on the Physiology of Drunkenness, detailing the evils produced by ardent spirits and fermented liquors, upon the human constitution.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—Will you allow one who has very lately commenced reading your useful little periodical, to enquire of some of your practically scientific readers, the way to make a solution of india rubber, and of applying the same to waterproof cotton and linen articles. I know that naptha is the usual menstruum: but some that I have had immersed for a fortnight exhibits no sign of dissolving. Perhaps you can, with less trouble, give me this information yourself. At your earliest convenience you will perhaps oblige me, as the occasion for which I require this information is very urgent.

I am, Sir, yours very respectfully,

FRANK.

ANSWERS TO QUERIES.

*Lightning Conductors.*—Sir,—in number 32 of your valuable work, your correspondent J. R. Watts, M. D., in answer to your correspondent N. O'Mel, proposes glass rods with metallic points, having a communication by chains to one of Dr. Franklin's metallic rods; he also says, care should be taken that the chains do not touch the building. Now there is no occasion for glass rods, neither is there any danger in having a communication, or rather having the chains touch the building, for electricity will not leave a prime conductor and enter a bad conductor, therefore there is no danger upon that head.

If you attach a chain to an electrical machine, you will perceive the electricity pass along it; if you then place a wire by the side, the wire being the nearest way, the electricity will pass along it: then if you take away the wire and place a cane or stick to it, or twist the chain round it, you will see the electricity pass down the chain, therefore electricity will sooner go a very long distance with a good conductor than enter a bad one, however short the distance. The plan I suggest, is, to have an upright metallic rod come up the side of the building, entering the ground either into a cespool or well, and to branch out into very fine points some distance apart several feet above the building. From all I can learn as to the utility of metallic rods, they appear in a great number of cases to have failed, therefore a building is perhaps safer without them, for they tend to draw the electricity. A principal feature in building houses is to avoid all metallic substances towards the top, but unfortunately it is unavoidable.

Yours truly,

Z. WIGO.

P.S.—I take this opportunity of expressing my thanks to you for the enlargement of your magazine, which I hope will meet with that approbation from the public in general, and get that circulation which it deserves.

*Quill Making.*—Sir,—the process of dutching or removing the film from a quill is effected by a person seated on a stool within reach of a clear fire, into which quickly thrusting and withdrawing the quill, he immediately brings it between an obtuse scraper, working by a joint, and a stump, both affixed to a stool or table, and pressing down the scraper with the left hand, the workman draws forth the quill. This is the method I have seen practised; but would not the immersion in boiling water be preferable to fire?

Yours respectfully,

W. L. CLEMENTS.

*Parkes' Fusible Alloy.*—Bismuth eight parts, lead five parts, and tin three parts, melted together in an iron ladle.

*Blue Lights.*—Saltpetre sixty parts, sulphur forty parts, and meal powder twenty parts. The ingredients should be made very fine, intimately mixed, and sifted. If made well, these blue lights will burn under water.

F. V. E.

## TO CORRESPONDENTS.

*We shall be glad to receive another drawing and description of* Mr. Porlington's *improved Window Sash; it appears to deserve attention.*

J. R. Watts. *We shall make use of some of the papers enclosed.*

Philo *shall appear.*

No Party Concerned. *We will endeavour to find room for the Letter in an early number.*

J. F. S.'s *Letter contains some remarks that deserve consideration, and shall, most probably, be published.*

Frank, *we think will find the information he requires in Number* 16.

J. H. B. *The first volume will be completed in October.*

C. H S.'s *Paper shall be inserted.*

*Received* Z. F. P.—D. G.—T. M.—* * *, *and* Firebrand.

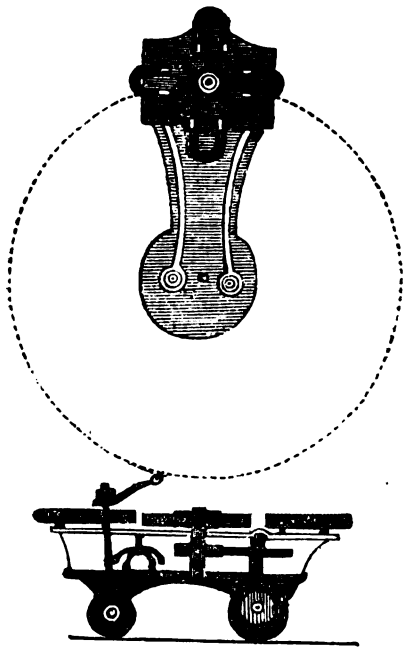
London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

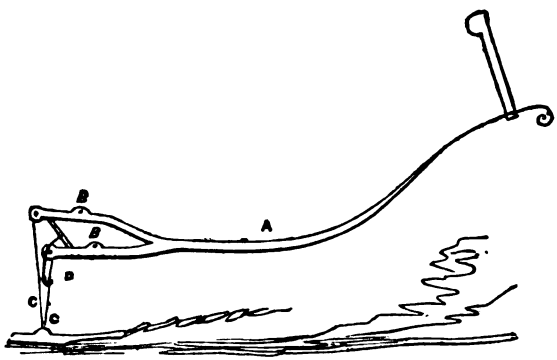
# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. XXXIX.] SATURDAY, JULY 22, 1837. Vol. I.

### DAVENPORT'S ELECTRO-MAGNETIC ENGINE.



### COACH DRAG.






Holloway Press: D. A. Doudney.

Digitized by Google

## DAVENPORT'S ELECTRO-MAGNETIC ENGINE.

*To the Editor of the* PENNY MECHANIC.

SIR,—In your 33rd number is a notice, taken from a New York paper, of Mr. Davenport's Electro-magnetic Engine, and you solicit further information on the subject. If the following crude account, the best I can give of it, is thought worth publishing, it is at your service.

PHILO.

I have seen Mr. D.'s model of a locomotive engine in action, and have conversed with him on the subject. He is a very modest unassuming man, and I heartily wish him success with his invention, which has been spoken of very highly by several scientific characters, who are expected to say something on almost all new schemes in which new branches of sciences are brought into operation; and perhaps, in the absence of positive indications of failure, it may be well for them to speak encouragingly, in order to create that interest in the subject which is necessary to enable the inventor to test the thing upon a large scale, as nothing short of this can be satisfactory. The anticipations of practical men, so far as I am informed, are not very sanguine, as to any favourable results from this invention, but they may be mistaken.

The model which I saw was a carriage 12 or 15 inches in length, with two wheels behind and one in front, and would pass swiftly round a circle of about two feet in diameter. It was made altogether of metal and very heavy; perhaps it weighed thirty pounds. I remember lifting it with my hands, and was surprised at its weight, but a larger one need not be proportionately heavy. The mechanism of this carriage consisted of four galvanic horse-shoe magnets, so placed that their eight ends formed a circle round a permanently-magnetic wheel, composed of eight arms, four of which being north, and four south poles, alternating with each other. The horse-shoe magnets are made of soft iron, with a hundred feet or more of copper bell-wire, covered with silk thread, and wound round them. The ends of these wires are connected with a galvanic apparatus, one wire is attached to the copper, and the other to the zinc, and in this way magnetic influence is given to the soft iron, which influence is reversed by reversing the wires, or changing the connections from the copper to the zinc, and *vice versa*, in rapid succession; and in this way a continual revolution of the wheel is kept up.

I have sketched two diagrams, which may assist the reader in understanding the mode of operation. In Fig. 1 the position of the magnetic wheel and horse-shoe magnets are shown, as well as the situation of the galvanic apparatus, near the centre of the circle. In the model which I saw a plate of metal extended from the carriage to the centre of the circle traversed by the engine, which served to guide the carriage, and support the galvanic apparatus, consisting of two separate cylinders of the capacity of not more than a pint each, and fitted up with concentric rings of copper and zinc. Two wires proceed from each of these vessels to the carriage; and here I am at a loss in giving the details of the manner of making the connections; but the reversing apparatus is very simple, consisting of two copper levers, each having four points very similar to spiders' legs. If the reader will suppose a four-legged animal suspended by its back to the upper plate of the engine, and alternately dipping its fore and hind feet into separate cups of mercury on the lower plate, he will have a pretty good idea of the action of these levers; one of which is sketched between the upper and lower plates of the engine in Fig. 2.

The connections between the magnetic wheel, and the wheels which run on the table or floor, can be traced in Fig. 2, and consists of two spur and two level gears.

If the mode of reversing the poles of the horse-shoe magnets were made clear—and I suppose some of your readers can supply this deficiency—the motions of the engine itself would be easy to comprehend; for, if we suppose the four wires of the alternate ends of these magnets to be brought in contact, they might all be operated upon simultaneously; and, if the arms of the wheel were placed between the ends of the magnets, as represented in Fig. 1, these arms would be repelled in one or other direction, and atrracted in the contrary one, until they came opposite the ends of the magnets, when the poles must be reversed in order to continue the rotation of the wheel; and this changing of the poles must take place as often as an arm comes opposite the end of a magnet, which in this case is eight times during each revolation of the wheel. But in some accounts which I have seen, it is stated that these poles are changed more than a thousand times in a minute.

The changing levers vibrate slowly at first, and increase in proportion to the speed of the engine. Their action is not governed by any mechanical contrivance, but they seem to be impelled by the gal-

Digitized by Google

vanic fluid as soon as the connections are made by the wires, and the machine stops when this connection is broken.

## COACH DRAG.

*To the Editor of the Penny Mechanic.*

SIR,—I send you a drawing of a Coach-drag to enable the driver to drag and undrag instantaneously, without stopping the horses, a model of which I exhibited at the annual meeting in 1835 of the Bath and West of England Agricultural Society, at whose rooms it may still be seen. If you think it worth a place in your Magazine, I shall feel obliged.

I am, Sir, your obedient Servant,
JOSEPH CARY.

Shepton Mallet.

A lever (A) is fixed by means of a joint (B B) under the hind axle; the drag-shoe is attached to the end of the lever by means of two uprights (C C), working in a separate joint in the forked end of the lever, but at the bottom they are forged into one, and are fixed to the shoe by a single joint. The reason for dividing the end of the lever into a fork, and using a double upright, is to give it sufficient strength to resist a strain sideways; it is necessary to keep back the upright in its place by a spring (D), otherwise the weight of the drag chain would pull it too forward.

To apply the drag the driver must lift the point of the guide (E), which is fixed to the side of the driving-seat, and place it over the hook on the top; this will press the shoe on the ground, and lift the wheel off,

I saw an account, about six months since, of a drag (invented by a gentleman of Oxford, if I mistake not,) and another in the newspapers lately, both of which act by friction on the wheel. I understand that friction-drags (many modifications of which have been tried), however effectual for a time, so heat and shake the wheel, that it soon destroys it; mine certainly will not do that, as it acts independent of the wheel altogether.

[We beg to recommend the above invention to the notice of the proprietors of the Paddington omnibuses that pass through Holborn and Oxford-street. The inconvenience of having to stop before proceeding up and down Holborn-hill and Snow-hill, might, we think, easily be remedied by adopting Mr. Cary's invention. The long stages that travel through hilly parts of the country would also find a drag of the kind above described of the greatest service; the expense of it would not be great; it might be made an ornament to a coach rather than an incumbrance. Those who have travelled on hilly roads know the inconvenience of being stopped every three or four miles, or two or three times in the course of a mile, in order to "lock the wheel;" the coachmen, however, feel it most, and we have no doubt would be happy to be relieved of the trouble of "pulling up" oftener than is necessary.]

## IMMATERIAL CAPITAL.

NO. I.

A FEW years since a prize was offered by an eminent philanthropist for the best essay upon the "Claims of Invention, &c." to be competed for by members of the London Mechanics' Institution, which was awarded at the anniversary meeting of the Institution to a talented but eccentric individual, whose name, however, I do not at present remember. I distinctly recollect that upon that occasion the president, Dr. Birkbeck, made extensive comments upon a term used by the essayist, which he had evidently coined himself, viz. "immaterial capital." The term was said to have been made use of as intending to designate that portion of the property of man which was not "current money with the merchants." In fact, the qualities of the mind, the mental talents which a man possesses, constitute his "immaterial capital."

The value of this kind of capital is very much misunderstood even in the present enlightened age; it is in general treated with a contempt which shows that the quintessence of ignorance has not even in the nineteenth century drained off into the channel of by-gone years, and is not spoken of by the world as "a tale that is told." It may always be esteemed as a proof and a manifest symptom of the barbarism of an age, when the esteem that a man meets with is regulated according to the quality of the coat on his back, and not according to the measure of talents he possesses. Let this test of civilization be applied to Britain, and we shall find that she is in this respect even behind the Esquimaux or the North American Indian. These savage children of nature are utilarians with a vengeance. A man is not esteemed among them for his stores of "barbaric gold and pearls," but for the qualities of his immaterial part, the talent he possesses, the *ingenuity* he displays in increasing the comforts of life, and in providing for his wants. Junius Redivivus has shown the method of *latent* protection, which they adopt in preference to what

Digitized by Google

may still be termed the humbug of *patent* law; and, though their rude ideas and manners are not worthy of imitation, their shrewdness and common sense are no debasing patterns for the minions of civilization to adopt. An improved method of taking fish or birds, or beasts of the forests, is held as truly valuable amongst them, and the inventor will avail himself of the protection which secresy affords; whilst that secresy is held inviolable, and even after, he is esteemed as a superior by those who are not so successful in their ideas; and so in England and other civilized countries, he may be esteemed as soon as he has branded his invention with a patent, but till then, till the gold has been brought forth, he is held to be a madman, a rogue, or a fool! There are, moreover, a certain class of individuals who have not a second idea of their own, and who want little more than a legal process to render them the inmates of a lunatic asylum: who, from the possession of a store of hard cash, which has descended from father to son, till it has come into their precious hands, invariably reap nearly all the advantages of the inventive genius of the country, by taking a mean and shameful advantage of the poverty of the class of inventors; and not content with the profits, they frequently pilfer the honest fame likewise.

To say that this resulted from the want of education would be an unpardonable truism, and we would not insult the common sense of our readers by such an assertion; but we would impress on them the necessity of an increase of their exertions to remedy the evil, by supplying this awful destitution. The real value of immaterial capital is always one and the same, and not arbitrary and fluctuating: it is moreover a capital which is far more indestructible than the gold which perisheth, and it is the brightest and the best endowment of a kind and gracious Providence: it is the natural inheritance of man, and not the acquisition of avarice, injustice, and fraud.

BASILIUS.

## MECHANICS' INSTITUTIONS.

*To the Editor of the* PENNY MECHANIC.

SIR,—I have frequently seen the numbers of the PENNY MECHANIC, among other periodicals for sale in various parts of the metropolis, but did not examine them, and from the appearance of the plates I had concluded that the articles were merely extracts, and intended for those persons who had but few books, and very limited knowledge of mechanical and scientific subjects. This impression has been recently removed, however, during an excursion through the north-eastern portion of the country. While travelling between Norwich and Yarmouth by a small steam-boat, in the cabin of which I had an opportunity of perusing most of the back numbers, furnished for the amusement of the passengers, and was much pleased to see the evidence of so much talent and good taste displayed in the work.

The attention paid to young inquirers, and to societies for popular improvement, struck me very favourably, as these are subjects congenial to my feelings, and to which my best efforts have been directed for many years.

I have been thus induced to make choice of the PENNY MECHANIC, by your permission, to lay before the operatives of London the following remarks for their consideration.

Among the various Mechanics' Institutions, it is a source of regret that so small a proportion of the members are belonging to the class of operatives; and, notwithstanding this is a subject of frequent complaint with many persons, yet nobody attempts to remedy the evil. In the smaller towns, societies must necessarily partake of a general and miscellaneous character, but in London, one would suppose, there might be a thousand mechanics found who would embrace the opportunity of uniting themselves to a society for improvement, provided they were assured the sole management would be in their own hands, and that the expenses would be within their means.

I need not dwell upon the fact, that the anticipations of the early promoters of Mechanics' Institutions are far from being realized, so far as the operatives are concerned. If any are disposed to doubt this, let them make the inquiry, and they will find it necessary, in some districts even in London, to visit many shops before they find an individual who is, or ever was, a member of a Mechanics' Institution, or any other society. I have been surprised to find so few who know anything about these Institutions, and yet it only requires a knowledge of the benefits to be derived from them, in order to their appreciation.

I would ask, is there not experience enough at the present day to form a Society of Mechanics for mutual improvement in the arts and sciences, upon an extensive scale and a sure basis? I think there is: and if these remarks should meet with the

Digitized by Google

responses of other persons devoted to the subject, who are willing to give it a fair trial, they may depend upon the co-operation of an

OPERATIVE MECHANIC.

*London, June* 24, 1837.

[We beg to call the attention of our readers to the above letter. The writer is known to us as one who will not flag in his exertions to render any plan successful that he may propose, or adopt from the suggestion of others. We shall be happy to do any thing in our power towards improving the mental and social condition of the industrious classes; and next week we will call their attention to a plan, which, if acted upon with spirit, may do much towards accomplishing this desirable object.—ED. P. M.]

## THE FINE ARTS

ALLAN Cunningham, in his "lives of the most eminent British painters, sculptors, and architects,"—a work that we cordially recommend to the notice of those who wish to learn something of the history of the progress of art in this country—gives a very happy description of the intimate connection that exists between the fine arts—showing their relation to each other, and the peculiarities by which each are distinguished. Poetry, Painting, Sculpture, and Music are the natural offspring of the heart of man. They are found among barbarous nations; they flourish among the most civilized; and springing from nature, and not from necessity or accident, they can never be wholly lost in the most disastrous changes. It may indeed be said that the tongue of poetry is occasionally silent, and the hand of painting sometimes stayed; but this seems not to effect the everliving principle, which may be justly claimed as their characteristic; they are heard and seen again in their seasons, as the birds and flowers are at the coming of spring; and assert their title to such immortality as the things of earth may claim. It is true that the poetry of barbarous nations is rude, and their attempts at painting uncouth; yet even in these we may recognize the foreshadowings of future excelleuce, and something of the peculiar character, which, in happier days, the geniuses of the same tribe is to stamp upon worthier productions. The future Scott, Lawrence, or Chantrey, may be indicated afar off in the barbarous ballads, drawings or carvings of an early nation. Coarse nature and crude simplicity are the commencement, as elevated nature and elegant simplicity are the consummation of art. When the Spaniard invaded the palaces of Chili and Peru, they found them filled with works of art. Cooke found considerable beauty of drawing and skill of workmanship in the ornamented weapons and war canoes of the islanders of the South Sea; and in the interior recesses of India sculptures and paintings, of no common merit, are found in every village. In like manner, when Cæsar landed among the barbarians of Britain, he found them acquainted with arts and arms; and his savage successors, the Saxons, added to unextinguishable ferocity a love of splendour and a rude sense of beauty, still visible in the churches that they built, and the monuments which they erected to their princes and leaders. All those works are of that kind called ornamental: the graces of true art, the truth of action, and the dignity of sentiment are wanting, and they seem to have been produced by a sort of mechanical process, similar to that which creates figures in arras. Art is indeed of slow and gradual growth; like the oak, it is long of growing to maturity and strength. Much knowledge of colour, much skill of hand, much experience in human character, and a deep sense of light and shade, have to be acquired, to enable the pencil to to embody the conceptions of genius. The artist has to seek for all this in the accumulated mass of professional knowledge which *time* has gathered for his instruction, and with his best wisdom, and his happiest fortune, he can only add a little more information to the common stock, for the benefit of his successors. In no country has painting risen suddenly into eminence. While poetry takes wing at once, free and unincumbered, her sister is retarded in her ascent by the very mechanism to which she must at last owe half her glory. In Britain, painting was centuries in throwing off the fetters of mere mechanical skill, and in rising into the region of genuis. The original spirit of England had appeared in many a noble poem, while the two sister arts were still servilely employed in preserving incredible legends, in taking the likeness of the last saint whom credulity had added to the calender, and in confounding the acts of the Apostles in the darkness of allegory.

## LONDON AND BIRMINGHAM RAILWAY.

*To the Editor of the Penny Mechanic.*

SIR,—Whether your anonymous Correspondent be related to "Jack," who does

Digitized by Google

so much execution upon some occasions, or justice, I do not know; but I say it is not always justice to act like "Jack's Brother." The tunnel under the Harrow-road, to which he alludes, certainly affords some reason for censure in its erection, particularly as the circumstance which you bring forward as an excuse does not bear upon the case. Nearly, if not the whole, of the tunnel was wrought by open cutting; consequently the difficulty of undercutting was avoided. The principal plea in excuse (if any ought to be allowed) is that the whole of the tunnel alluded to is out of the straight line, and therefore the centreing (I suppose in consequence of not making sufficient allowance in the framework of the arch) was continually being altered to allow for the curve or bend of the line. As to *danger*, it would be absurd to apprehend any: and if your Correspondent had ever been under the tunnel of the Regent's Canal he would most probably think so. In the latter case large portions of the brickwork protrude and yet no mischief has resulted, or is any likely to occur. As to humidity, the whole of that tunnel, to the present hour, is affected by it to a much greater extent. It should be considered also that at the time the earth was thrown upon the work of the Harrow-road tunnel (it being mostly in the winter) the rain and snow saturated it so completely that it was impossible but it would show itself: your Correspondent and his friends will find, when the earth, in a few months, has settled upon the arch, that this will form no ground of objection. The protrusion of the mortar I take to have arisen from another cause, and which, in public works, ought to be made a consideration. The materials in this instance were the best, but the lime not being allowed sufficient time to temper, in consequence of the humidity and the pressure united, and the work being very much hurried, caused the crush to take place before sufficiently set. This, however, may be remarked, that should such another tunnel be formed, it would, under such circumstances, be better to put the first layer of bricks upon the arch in cement, and the rest in mortar, which would, under the most humid circumstances, always secure to the work a more sightly appearance. The Primrose-hill tunnel is arched in with cement, and bears me out in the suggestion; and few persons will be found to object to its construction. As to stuccoing the tunnel, it could afford no security, and would be a needless outlay of capital.

I am, Sir, yours respectfully,

NO PARTY CONCERNED.

[We have received a second letter from the Correspondent who first wrote to us on the subject, in which he says, "the stability of the tunnel is quite unquestionable, nor did I say any thing to the contrary. I stated that it appeared to be carelessly built, and that there was an appearance of danger, which, considering the prejudice that exists against travelling in tunnels, the Company, in justice to themselves, ought to have prevented."—ED. P. M.]

*Aldersgate-street Institution.*—Although this Institution does not offer quite so many advantages to the members as the Mechanics' Institute noticed in our last Number, yet it is equally, indeed more successful, as the building debt has been paid off, which is not the case with the former Institution. The subscription is two guineas per annum, payable half-yearly, which entitles a member to the following advantages:—Lectures every Wednesday evening, on subjects connected with literature and science. The lectures of the first kind appear to be the more general. A Library, containing nearly 7000 volumes. The reading room is supplied with nearly all the newspapers and magazines. Classes also exist for the study of the French, German, Latin, and Greek languages, elocution, natural philosophy, and music. A concert is given once a fortnight by the latter class, when each member of the Institution is allowed to introduce a friend. The same rule, we believe, exists with respect to the elocution class, at which the discussions are carried on with much spirit. The Institution is very flourishing, and from the manner in which it is conducted it deserves success.

*Engine for Copying Busts.*—Many years since, the late Mr. Watt amused himself with constructing an engine to produce copies of busts or statues, either of the same size as the original, or in a diminished proportion. The substances on which he operated were various, and some of the results were shown to his friends, but the mechanism by which they were made has never been described. More recently, Mr. Hawkins, who had also contrived several years ago a similar machine, has placed it in the hands of an artist, who has made copies in ivory of a variety of busts. The art of multiplying in different sizes the figures of the sculptor, aided by that of rendering their acquisition cheap, through the art of casting, promises to give additional value to his productions.—*Babbage.*

Digitized by Google

# THE CHEMIST.

## APPARATUS.

Persons, when commencing the study of Chemistry, generally throw away a great deal of money in the purchase of apparatus for which they have no occasion, or which might as well be supplied by some of a less expensive dercription, and probably better suited to the wants of the student. As we do not suppose any of our readers wish to spend more money than is absolutely necessary, we advise them only to purchase apparatus and chemicals as they require them, and not to purchase a quantity under the idea that at some time or other they will become useful. One of our best chemists has said, that a chemical laboratory, though extremely useful, and even essential to all who embark extensively in the practice of chemistry, either as an art, or a branch of liberal knowledge, is by no means required for the performance of those simple experiments which furnish the evidence of the fundamental truths of the science. It is even advisable that the construction of a regular laboratory should be deferred till the student has made some progress; for he will then be better qualified to accommodate its plan to his own peculiar views and convenience. If this advice is applicable to those who can afford the requisite funds to fit up a laboratory, it applies with greater force to those who wish to proceed in the most economical manner they can, and whose laboratory, when completed, must be contained in a chest or closet. The most economical apparatus we ever remember to have seen employed for the purpose of chemical experiment, was used by Dr. B. Reid, at a lecture we had the pleasure of hearing him deliver some time since, when he explained the system adopted by him in teaching large classes of students at Edinburgh. For the purpose of examining substances in solution, evaporating, crystallizing, filtering, and testing an immense variety of substances, Dr. Reid employed only some small slips of window glass. It is desirable that a student should accustom himself to experiment upon small quantities of matter, and by using the simple apparatus just mentioned he is enabled to do so with the greatest facility. A few drops of any liquid placed upon a piece of window-glass, can be tested with as much accuracy, and the experiment may be conducted as successfully, as if twenty times the quantity had been operated upon, and the student will have the advantage of becoming more expert than if he used the greater quantity. For the purpose of experimenting on the gases, a Florence flask and a bent glass tube, with a cork to fit tightly into the mouth of the flask, will be found much more economical to use than a retort; a little practice will enable a person to operate with the one as easily as with the other; and if a dozen of the flasks are broken they may be replaced for eighteen pence or two shillings, at any oil shop; while two or three retorts will cost as much as the whole of them; and when commencing the study of Chemistry the student must expect to break more than two or three retorts. We would therefore recommend him not to be so anxious to be able to perform a variety of experiments as to understand thoroughly the rationale of a few. If he acts on this advice, a shilling or two will be quite sufficient to supply his laboratory, at the commencement, with any thing that is neceesary; and as he becomes better acquainted with the science he will be more able to select his apparatus.

*How to brew Beer.*—The art of brewing is very easy to be understood, for it is exactly similar to the process of making tea. Put a handful of malt into a teapot, then fill it with water, the first time rather under boiling heat. After it has stood some time, pour off the liquor, just as you would tea, and fill up the pot again with boiling water; in a similar manner pour that off, and so go on filling up and pouring off till the malt in the pot is tasteless, which will be the case when all the virtue is extracted. The liquor, or malt tea, thus extracted, must then be boiled with a few hops in it, and when it becomes cool enough, that is about blood-heat, add a little yeast to ferment it, and the thing is done. This is the whole art and process of brewing, and to brew a large quantity requires just the same mode of proceedure as it would to make a tea breakfast for a regiment of soldiers. A peck of malt and four ounces of hops will produce ten quarts of ale, better than any that can be purchased in London, and for which purpose a tea kettle and two pan mugs are sufficient apparatus. A bushel of malt to one pound of hops is the general proportion; and eighteen gallons of good light ale, or table ale, may be produced from one bushel of malt, and one pound of hops, which *will not cost above seven shillings*, that is, sixpence a gallon, or three halfpence a quart. Brewing utensils, consisting of a marshing tub and oar, a sieve, two coolers, and wicker hose, a spiggot, and faucet, together with a couple of nine-gallon barrels, new from the cooper's, cost but thirty-six shillings.

Digitized by Google

# INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, July 26, adjourned Quarterly Meeting.—Friday, 28, Professor Calvert, on Elocution and the art of Reading, at half-past eight.

*Eastern Athenæum*, Stepney-green.—Wednesday, July 26, Dr. Mitchell, V. P. of the Institution, on Palestine, at eight o'clock.

*Gower Street Institution*, New-road.—Tuesday, July 25, Mr. Dalton, on Animal Physiology, at eight o'clock.

*Bermondsey Mutual Instruction Society*, British School-room, Great George-street.—Wednesday, July 26, T. B. Barret, Esq., on Digestion and Nutrition. at a quarter past eight o'clock.

*Tower-street Mutual Instruction Society.*—Monday, July 24, Mr. Lee, on the Administration of the New Poor Law, at eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, July 25, Mr. Johnson, on Oratory, at half-past eight o'clock.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Electrical Apparatus.*—Sir,—Perhaps your Correspondent F. V. E. will inform me, through the medium of your useful Publication, how to make the hole in the bottle mentioned in his ingenious article on Electrical Apparatus (in Number 37), without breaking it: and will you inform me what Number J. H.'s Leyden Phial (referred to by F. V. E.) appeared in.

Your well-wisher,
J. H. B.

[In Number 32.—Ed. Pm.]

*To melt Iron.*—Sir,—T. N. will fell much obliged by being informed, through the medium of your valuable work, in what manner he can melt a small quantity of iron—about half-a-pound.

*Staining Brass and Steel.*—Sir,—I shall feel obliged if I can be informed of what the liquid bronze is composed, by which brass workers produce a black colour upon polished brass work; and what composition will produce a jet black stain upon steel and iron.

Your Obedient Servant,
T. N.

*De Luc's Columns.*—Sir,—How are the philosophical toys constructed, which have, for some time past, been exhibited in the shops of the scientific instrument makers; and which, I believe, are generally known by the name of De Luc's Columns. I am aware the motion of the figures is owing to galvanic influence, which is continually kept up in the columns to which they are alternately attracted; but I am at a loss to know how these colums are constructed.

Sciolisterus.

### ANSWERS TO QUERIES.

*Blue Lights.*—Sir,—I beg to inform D. J. that these Lights are fixed in conical hard cases of well-seasoned birch or alder, and above seven inches long.

In the broad end is an excavation, or cup, about two inches in diameter, by one in depth, for holding the composition.

The ingredients are in the following proportions: saltpetre seven parts, sulphur two parts, and three-fourths red orpiment. They are first pulverized, then rubbed between the hands, and afterwards passed through a hair sieve, since the brilliancy of the light depends upon the purity and thorough incorporation of the materials.

When the cup is filled and levelled, place a square of cartridge paper with two strands of quick-match across the centre, and tie the paper down round the head of the case. Complete by pasting a circle of brown paper over all.

I am, &c.,
Firebrand.

*Gilding Picture Frames.*—The frame must first be painted with a mixture of white paint and size eight or ten times over with a stiff brush. When it is thoroughly dry rub it over with pieces of course linen. The next thing to be done, is to colour it with yellow ochre, which must be well ground and sifted, and mixed up with size, the colour is to be laid on hot; and in works of sculpture supplies the place of gold, which sometimes cannot be carried into all the cavities of foliages and ornaments. Another layer is applied over this yellow, composed of armenian bole, blood stone, black lead, and a little fat: these being ground down together with hot size, three layers of this composition is applied upon the yellow, the one after the other has dried, being cautious not to put any into the cavities of the work to hide the yellow; the brush for this must be a soft one; and when very dry, it must be gone over again with a stronger brush. The next thing is gilding: you first take a pencil moistened, and wet part of it over with water; then with a squirrels tail fitted with a handle, take the leaf off and lay it gently on the wet part, then another part, and so on. Sometimes the leaf cracks in laying it on; these breaches must be made up with small bits of leaf taken up with a pencil, and the whole to be smoothed over with the same pencil, which must be a very fine one: any little defects afterwards may be mended with shell gold. The last operation is applying the vermeil (a composition of gum, guttæ, vermillion, and ruddy brown, ground and mixed up with venetian varnish and oil of turpentine) in all the little lines and cavities of the frame.

If the above is of any service to G. S. H. he is welcome, and the insertion will oblige Z.

## TO CORRESPONDENTS.

C. G. *We shall be happy to receive the papers. They will, we have no doubt, be acceptable to our readers.*

Z. F. P. *We cannot answer the query at length, any elementary work on electricity will give him all the information he requires.*

D. G.'s *suggestion shall not be forgotten.*

*An improvement by a* Mechanic *of the* Alarum, *described in Number 37, shall appear in an early Number.*

Several Queries and Answers *have been received, and shall be inserted as soon as possible.*

Mr. Payne, *and several other Correspondents, whose communications are accepted, shall have them published directly we can spare room for them.*

*We must again request our Correspondents to direct their letters* To the Editor of the Penny Mechanic, *and not to the Publisher.*

*Two or three letters have been returned to the Post Office this week, in consequence of the postage not having been paid.*

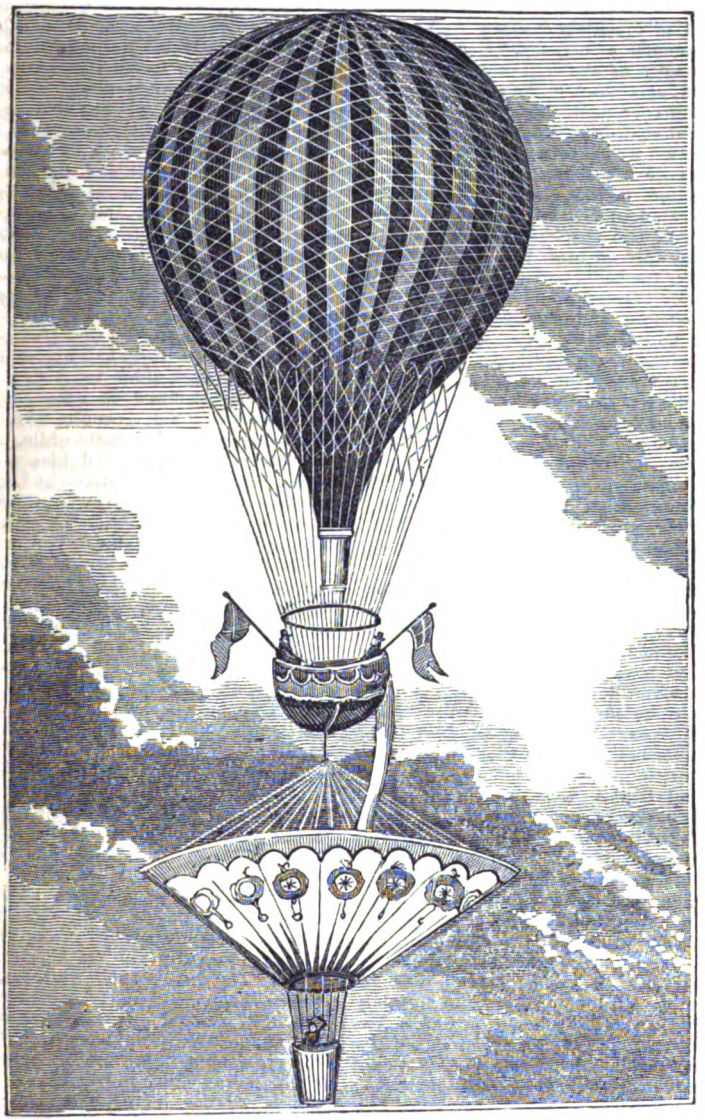
London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. XL.] SATURDAY, JULY 29, 1837. Vol. I.


MR. COCKING'S PARACHUTE.



*Drawn on the spot, and Engraved by* G. H. Wall.


Vol. I.—No. XL. Holloway Press: D. A. Doudney.



Digitized by Google

## FATAL RESULT OF THE PARACHUTE DESCENT.

We regret to have to state that the experiment of the descent of the parachute has terminated fatally to Mr. Cocking. In consequence of the announcement that he was to ascend in his parachute suspended to the great Nassau Balloon, a great number of persons, amongst whom were many of the first nobility of the country, assembled in the gardens to witness the experiment. Without the gardens, upon Vauxhall-bridge, and upon Millbank, the crowd was immense. It was in circumference 107 feet four inches. From the bottom of this machine, which was constructed of fine Irish linen, a basket of wicker was suspended, in which Mr. Cocking placed himself. The distance between the basket and the car in which were Mr. Green and Mr. Spencer, was between forty and fifty feet. The ascent of the balloon took place about twenty minutes before eight o'clock. When Mr. Cocking entered the basket of the parachute he was perfectly collected, and exhibited no appearance of want of nerve or indecision.

At twenty minutes to eight o'clock, every thing being in readiness and the parachute attached to the car of the balloon, the ascent took place. Nothing could be more majestic. The weight and great extent of the parachute apparently rendered the motion of the balloon more steady than on any former ascent, and the almost total absence of wind assisted in keeping the balloon in a perfectly perpendicular position. There was not the slightest oscillation; the balloon and parachute sailed through the air with a grandeur which exceeded anything of the kind even before witnessed, and continued in sight for about ten minutes. A good deal of ballast was discharged almost immediately over the enclosure, after which the huge machine rose rapidly, but not so suddenly as to break the even current of its course. It was expected by those in the gardens that Mr. Cocking would have descended so near Vauxhall as to afford them a view of his descent. This was not the case. He was lost in the clouds, and the coumpany were for some time left in conjecture, but certainly not in anticipation of the result of the experiment. A son of Mr. Gye was the first person who announced to our informant the fatal catastrophe. This gentleman followed on horseback, and arrived in a field, near Lee, in Kent, just in time to learn that the parachute had descended with such violence, that Mr. Cocking had lost his life in his experiment. The intelligence was not suffered to transpire for some time in hopes that the account might be incorrect, and that Mr. Cocking might have only been stunned, or have fainted, it being remembered that something of this sort occurred on the descent of M. Garnerin some years ago. It was, however, very shortly ascertained that the intelligence was too true. It appears that the descent of the parachute was made over a field close to Lee; that on approaching the ground the parachute, from some cause or other, most probably from the hoop which distended the external circumference being composed of a hollow tube of tin, collapsed, and consequently opposed no resistance whatever to the atmosphere, but turned over and over in the air, and came down with a frightful velocity. Mr. Cocking was not, as we are informed at present, thrown out of the basket, but he received a dreadful wound on the right temple, and had his ancle dislocated. He moved his hand once after his fall, but exhibited no other signs of life. Several country people, who were close by, procured a watled hurdle, placed him upon it, and conveyed him without delay to the Tiger's Head Inn at Lee. He was immediately attended by Dr. Chownne, who was on the spot; but all medical assistance was unavailable. The arteries of his arms were opened, but it was to no purpose, life had fled. Is is but justice to say, that this fatal result is attributed in no manner to any person connected with Vauxhall or with the balloon. Mr. F. Gye endeavoured, but in vain, to persuade Mr. Cocking to have the hoop of the parachute of ash, but that unfortunate gentleman, from a notion that tin would be sufficiently strong and much lighter, refused to listen to his suggestion.

"The inflation," says Mr. Green, "commenced about 12, under the able direction of the engineer to the London Gas Company, and was completed by 5 o'clock. Prior to the parachute being attached to the balloon I caused a trial to be made with the view of ascertaining whether the buoyance of the latter was sufficient to carry up the former with safety. The result of this trial was, after some arrangements with respect to the ballast, of which I was compelled to give out about 650lbs. in weight, in every respect, satisfactory. The abandonment of this large quantity of ballast I found to be absolutely requisite in order with safety to commence the ascent. The balloon was then allowed gently to rise a sufficient height to be conveyed over the

Digitized by Google

parachute; but in consequence of the great and unavoidable delay which was necessarily caused in affixing the two machines, the gas in the former became very considerably condensed, from a reduction of its temperature. It, thereupon, became a matter of compulsion that I should get rid of 100lbs. more of the ballast, which I emptied out of the bags through a tube, constructed of canvass, and about fifty feet in length. The object in having this tube was, that any ballast I might deem it advisable to throw out during our voyage should take such a course as would entirely clear the broadest expanse of the parachute. The connexion between the balloon and the parachute was at length completed by the rope of the latter being made fast to the liberating iron by which Mr. Cocking was to free himself from the balloon.

"It is but justice to myself I should here state, that I had on several occasions expressed my determination not to liberate the parachute from the balloon, upon the ground, setting aside any other considerations, that I might select a moment for the severance when Mr. Cocking was not altogether prepared or ready for his descent, and therefore if any accident were to accrue to him, that I of course should be regarded as the responsible party, and the one to whom blame would naturally attach.

"Mr. F. Gye, every thing being in readiness, about twenty-five minutes to eight o'clock, gave the signal for the whole of the apparatus to be released from its trammels, and we instantly rose very steadily, taking an easterly course.

"Mr. Cocking had always desired that we should ascend to an elevation of 8,000 feet, about one mile and a-quarter, at which height he proposed to detach himself from the balloon, and to commence his descent. Finding, therefore, that our upward progress was very slow, I requested Mr. Spencer to discharge some more ballast, and he accordingly threw the contents of a bag weighing twenty pounds through the tube already named. This proving of little avail, I directed a second and then a third bagfull to be got rid of by the same means.

"As soon as we had attained the height of 5,000 feet I told him that it would be impossible for us to get up as high as he desired in sufficient time for him to descend by the light of day. Upon this Mr. Cocking said, 'Then I shall very soon leave you; but tell me whereabouts I am?' Mr. Spencer, who had a few minutes before caught a glimpse of the earth, answered, 'We appear to be on a level with Greenwich.' I then asked him if he felt himself quite comfortable, and whether he found that the practical trial bore out the calculations he had made? Mr. Cocking replied 'Yes; I never felt more comfortable or delighted in my life.' Shortly afterwards Mr. Cocking said, 'Well, now I think I shall leave you.' I answered, I wish you a very good night and a safe descent, if you are determined to make it, and not to use the tackle (an apparatus constructed under the direction of Mr. F. Gye, to afford us the facility of assisting Mr. Cocking to haul himself up into the car of the balloon if necessary.) Mr. Cocking, to this question, made no other reply than 'Good night, Spencer: good night, Green.' At this instant I desired Mr. Spencer to take fast hold of the ropes, and like myself to crouch down in the car. Scarcely were these words uttered before we felt a slight jerk upon the liberating iron, but quickly discovered, from not having changed our elevation, that Mr. Cocking had failed in his attempt to free himself. Another but more powerful jerk ensued, and in an instant the balloon shot upwards with the velocity of a skyrocket.

"The effect upon us at this moment is almost beyond description. The immense machine which suspended us 'between heaven and earth,' whilst it appeared to be forced upwards with terrific violence and rapidity through unknown and untravelled regions, amidst the howlings of a fearful hurricane, rolled about as though revelling in a freedom for which it had long struggled, but of which, until that moment, it had been kept in absolute ignorance. It at length, as if somewhat fatigued by its exertions, gradually assumed the motions of a snake working its way with astonishing speed towards a given object. During this frightful operation, the gas was rushing in torrents from the upper and lower valves, but more particularly from the latter, as the density of the atmosphere through which we were forcing our progress pressed so heavily on the valve at the top of the balloon as to admit of comparitively but a small escape by that aperture.

"At this juncture, had it not been for the application to our mouths of two pipes leading into an air-bag with which we had furnished ourselves previous to starting, we must, within a minute, have been suffocated; and so, but by different means, have shared the melancholy fate of our friend. The gas, notwithstanding all our precautions, from the violence of its ope-

Digitized by Google

rations on the human frame, almost immediately deprived us of sight, and we were both, as far as our visionary powers were concerned, in a state of total darkness, for between four and five minutes.

"As soon as we had partially regained the use of our eyes, and had somewhat recovered from the effects of the awful scene into which, from the circumstances we had been plunged, our first attention was directed to the barometer. I soon discovered that my powers had not sufficiently returned to enable me to see the mercury, but Mr. Spencer found that it stood at 30·20, giving an elevation of 23,384 feet or about four miles and a quarter. I do not conceive, from the length of time I had been liberating the gas, that this was any thing like our greatest altitude, for we were evidently effecting a rapid descent.

"Recollecting the late hour at which we quitted Vauxhall, I now began to be anxious about the time, and on applying to Mr. Spencer, ascertained that it wanted not more than a quarter to nine o'clock. From this I was aware, notwithstanding in our then position we were blessed with a magnificent light, that on emerging from below the clouds darkness would have assumed her sable hue over the earth, and that we should have much difficulty, therefore, in ascertaining the nature and character of the country, supposing us to be over the land, on which we must effect our final descent. I consequently became extremely anxious to make our way through the clouds as quickly as possible, which having done, we proceeded until we had reached within some 300 feet of the ground, when we found it requisite, from our inability to ascertain the nature of the ground, the whole country beneath us offering the appearance of thick woods, to cast out every article of ballast and moveable matters, even the ropes and empty ballast-bags, in order to prevent us from coming in contact with what was supposed to be trees. After calling out for some time, and hanging out the grapnel, we heard voices in reply, and the parties speedily drew us to a safe place of landing, which proved to be close to the village of Offham, near Town Malling, seven miles west of Maidstone, and twenty-eight from London.

"At half-past ten o'clock this morning we quitted Town Malling, and it was not until our arrival at Wrotham, at which place I inquired whether they had heard where Mr. Cocking had descended, that I became acquainted with the unexpected and melancholy result of his experiment."
—*Times.*

## SAINT MONDAY.

### DULWICH GALLERY OF PAINTINGS.

At this season of the year, we advise all our readers living in and near London, who can spare an afternoon from their employments, to visit the Dulwich Gallery of Paintings. It is a beautiful collection, and the public are admitted without having to pay anything either for admission, or to the attendants at the gallery. The paintings were bequeathed to Dulwich College by Sir Francis Bourgeoise in 1811, on condition, we believe, that the public should be admitted to view them *gratuitously;* and the directions of the testator have been acted upon in a liberal spirit, which it would be well for the public if the trustees of other bequests for the benefit of the nation would imitate.

Dulwich Gallery is situated about five miles from London Bridge. From April to November, it is open from ten o'clock in the morning, till five in the evening. During the winter season, from November to April, it is open from eleven till three. It is closed on Fridays and Saturdays throughout the year. In order to be admitted it is requisite to procure a card, which must be presented to the keeper of the gallery. Messrs. Moon, Boys and Graves, of 6, Pall Mall; Mr. Moon, Finch Lane, Cornhill; Mr. Markby, Croydon; and Mr. Dunkin, of Bromley, will all give tickets of admission on being applied to for them; and it is requssite that those who wish to view the paintings should provide themselves with tickets before leaving town, as they will experience great difficulty in obtaining any at Dulwich. The door-keeper will not admit visitors without presenting a ticket; but one is sufficient to introduce a party. On entering the visitors have to write their names and addresses in a book kept for the purpose; and they are then at once allowed to enter the gallery. It consists of one long room, divided into compartments, and contains between three and four hundred paintings, which are nearly all in very good condition. Some few want cleaning; and some—one in particular—we think it would be advisable to remove altogether, although to the artists and connoisseur such paintings as that to which we allude may not appear to overstep the modesty of nature, we are inclined to believe that the majority of the visitors at the gallery think otherwise. We are no advocates for the modesty that would clothe the Apollo Belvide in breeches, but a painting that might not be improper in a private collection, is sometimes unfitted for a public exhibition, and

Digitized by Google

we think this to be the case with the one alluded to. We suppose however that the trustees, or governors of Dulwich College, to which the gallery is attached, have good reasons for continuing the painting in the collection, and also for removing the veil, which we believe was once placed before it. Among the paintings the visitor will find the celebrated portrait of Mrs. Siddons as the Magic Muse, by Sir Joshua Reynolds; the Descent from the Cross, by Vandyke; the Martyrdom of Saint Sebastian, by Guido; and the Group of Cupids, by Rubens. Besides these the gallery contains some very excellent specimens of the Italian and Flemish schools; and the works of our English masters will be found equally worthy of attention. Artists wishing to copy any of the paintings, can obtain leave to do so on making application by letter to the Master of Dulwich College, and forwarding their name and address.

The excellent state of preservation of the pictures, and the entire absence of any of those scratching and scrawlings by which many persons like to make it known that they have visited and disfigured any work of art, &c., affords, we think, sufficient proof of the injustice of the charge, that the exhibition of such works cannot be thrown open to the public without leading to their mutilation and disfigurement. It is true that the public being admitted to this gallery by tickets, there is some slight check upon those who might otherwise be inclined to misconduct themselves; and the attendants also protect the paintings; but when it is borne in mind that many places to which admission can only be obtained either by a douceur to the attendants, or by paying a certain fee, have not escaped the "English propensity," we think there is very good reason to conclude, that where the visitors of an exhibition, being admitted free, feel that any injury to the works exhibited, is an injury to themselves, there is far less likelihood of their permitting it to be effected, than where they feel they are only viewing some persons' property, about the preservation of which they may feel but little interest or concern.

## WORKING MEN'S ASSOCIATIONS.

We stated last week that in our present Number we should call the attention of our readers to a plan, which if acted upon with spirit, would do much towards effecting that social amelioration in the constitution of the industrious classes which must eventually take place, and which every good man will endeavour to promote as far as possible. The working classes of Great Britain, and of the metropolis and manufacturing towns in particular, occupy a station in society, and possess a political influence unknown to the operatives of other countries of Europe. We do not except even those of France. Within the last few years they have made a rapid, and to some, it may appear an extraordinary advance. They are no longer mere hewers of wood and drawers of water, and though the greater majority of them, it is true, do not possess the elective franchise, they influence those who exercise it to a considerable extent. Indeed, we think the power of no class of society has increased so rapidly, and is increasing so rapidly, as that of the working classes. This change is to be attributed entirely to their intellectual improvement. And this we think has been produced principally by the establishment of Mechanics' Institutions and the cheap diffusion of knowledge of every kind by the press. In no country in the world—not even in America—does a working man possess such facilities for improving his mind as in this country. Compare the condition of a mechanic in Spain, in Russia, or in Turkey, with that of a working man in England. See the vexatious tyranny and impertinent interference to which the first is subjected, and then turn to our own countryman and mark the difference. There are many who are fond of doing this, but only in order to draw from the comparison conclusions as erroneous and absurd as any that can be imagined. It is surely no reason because men in one country submit to be treated but little better than beasts, that those of another should be content to labour under social disqualifications, for which no other reason can be assigned, but that they are submitted to by men in other countries. Such, however, is too frequently the conclusion that many persons arrive at from comparing the state of foreign workmen with our own, but we have alluded to the circumstance for a very different purpose. What is it keeps the operatives of the countries mentioned in the condition they are in? It is the want of co-operation; and the consequent want of that knowledge that can only be obtained by co-operation. A striking feature in the history of the working classes during the last few years has been the manner in which they have shown the advantages of combining together for the accomplishment of any particular object. Their

Digitized by Google

great political unions astonished the other classes of society; and their uniting for the purpose of obtaining scientific knowledge and literary recreation at mechanics' institutions is a new feature of the age. There are certain difficulties attending the formation of these excellent institutions, however, which render it difficult, if not impracticable, to establish one successfully except in towns containing a large population; and even in such a place as London, where so many are prospering, and where probably all the advantages that can be obtained from them are derived from the members. Yet even there it is felt that something more requires to be done in order to derive from them all the advantages they are capable of producing. In the majority of these institutions there is a sad want of social feeling amongst the members. They attend at the library for the books they require; they visit the reading rooms to see the newspapers; and they meet in the theatre to hear the lecture; but unless some few of the members are possessed of more spirit than the others, and "get up," a ball or an excursion occasionally, but very few acquaintances are formed between the members, and one great advantage that might be derived from such institutions is lost. Many of the members of the London Mechanics' Institution some two or three years ago felt this inconvenience so much, that they formed themselves into what they termed a Mutual Instruction Society. The members were in the habit of meeting once a week in a private room at a coffee-house, and discussed questions relating to moral philosophy, metaphysics, and occasionally lectures were delivered on different branches of science by members. This society for a considerable time proceeded very successfully, and numerous societies of a similar nature were formed by its members, and those who approved of the plan. These societies have since spread rapidly over London, and many have been formed in provincial towns. The members have generally been young men, but within the last twelvemonth, a new application of the principle has been exhibited by the establishment of what are called "Working Men's Associations." We intended to have given a description of their objects and advantages in the present number, but finding we have not room to do so, we must resume the subject next week

## CHEAP ELECTRIC APPARATUS.

*To the Editor of the Penny Mechanic.*

Sir,—Observing in Number 37 of your useful periodical, a description of a cheap electrical apparatus, which to me appears not quite so clear as I think it should be, to be understood by that portion of your readers to whom, I apprehend from the tenor of the communication it is particularly addressed, namely, the juvenile portion, and of which I am happy to say, I know there are many who purchase it, I take the liberty of sending you a few observations thereon, which I think will be acceptable to many who have read that article; and will not be regarded with any ill feeling by your correspondent T. V. E.

Your correspondent begins his description by saying "make a hole through the bottom, and opposite the mouth of a common wine bottle;" now I venture to assert that had T. V. E. ever made "a hole through the bottom of a common wine bottle." he would find that it is "no joke" to drill a hole through a piece of glass of that thickness, and therefore would not, in giving a description of a cheap Electrical Apparatus, recommend others to do so. Having made, about two years ago, an electrical machine from a common wine bottle, I can inform your readears of a much easier mode of making an axle to their bottle; there is no occasion to make a hole through the bottom, they have only to form from a small block of wood a counter part to the indentation at the bottom of the bottle, from which their axle can project so as to fit in loosely; but I will not leave your readers as T. V. E. does, by saying, "and fix it firmly in the bottle," they must know "how" to fix it firmly in the bottle. It is as follows: make a cement as described in the last column of Number 9 of this Magazine, after having melted a sufficient quantity, pour it into the bottom of the bottle, and then imbed in it the little block of wood in which your axle is fixed. This cement will be found well worth the trouble of making, being particularly useful in fixing the conductor on the glass rod, and in fixing the glass pillars, many of which are required in constructing electrical apparatus.—I now beg to make an addenda to your correspondent's description of the conductor: let a row of pins, with the points outwards, be driven into the small cylinder so as to come within a quarter of an inch of the bottle, these will draw off the electricity, and you will be able to accumulate in the conductor a much greater quantity than you could without them. By inserting the above you will oblige, Your obedient humble servant,

Scolisterus.

Digitized by Google

# THE CHEMIST.

## PREPARATION OF IODINE.

BY M. BUSSY.

The process of extracting iodine generally followed, and which consists in decomposing the mother-waters of kelp by means of concentrated sulphuric acid, is well known to be liable to variable results, on account of a portion of the iodine coming over in the state of hydriodic acid and chloride of iodine, so that in either case there is always a considerable loss. To avoid this inconvenience, M. Souberain proposed to precipitate the iodine from the mother-waters by means of sulphate of copper, and afterwards to decompose the iodide of copper by peroxide of manganese at a high temperature. But this process requires minute attention and much precaution to separate the whole of the iodine existing in the mother-waters, and we do not believe that it has been employed in any manufactory. These circumstances induce me to publish a far more simple method which has been lately employed by some manufacturers of iodine; it was discovered (if we are rightly informed) by M. Baruel, director of the chemical works at the faculty of Medicine; it consists in precipitating the iodine of the mother-waters of kelp by a current of chlorine. In this process the mother-waters are first to be evaporated to dryness, and to the residue there is to be added a tenth of its weight of powdered peroxide of manganese; the two substances are to be perfectly mixed, and subjected to a dull read heat in an iron vessel, frequently stirring them; the object of this calcination is to convert the sulphurets and hyposulphates, of which the mother-waters contain a large quantity into sulphates. It is extremely easy to determine when these compounds are converted into sulphates by taking a small quantity of the calcined matter and pouring upon it an excess of sulphuric acid. It ought not to yield, when the conversion is perfect, either sulphuretted hydrodgen or a deposit of sulphur. If violet vapours are disengaged during the calcination, the heat must be lowered to avoid loss. When the sulphurets are decomposed, the residue is to be dissolved in a sufficient quantity of water to give a solution of sp. gr. 1·333; through this solution there is then to be passed a current of chlorine gas, taking care to stir it constantly with a gas rod: the liquor becomes of a deep brown colour, afterwards turbid, and deposits iodine in the form of a black powder; it is to be collected and distilled in a glass retort, in order to procure it in crystals. The only difficulty in this process is to determine the point at which the action of the cholorine should cease, that no excess may be used which would react upon the iodine precipitated. This excess of chlorine is especially to be apprehended, when it is also intended to separate from the same mother-waters the bromine which they contain.

In order to avoid adding excess of chlorine, the liquor which is supposed to be nearer saturation, may be suffered to be settled for a short time, and the current of chlorine being interrupted it is to be directed on the surface of the liquid. If it contain any iodine in solution, a pellicle of iodide will be observed to form on the surface; this effect is not produced when all the iodine is precipitated; in the latter case the liquor becomes quickly clear and retains only a reddish tint.—*Philosophical Magazine.*

*Constitution of Starch.*—M. Payen, in a memoir, quoted in the *Journal de Pharmicie*, states that starch in whatever manner or from whatever part of vegetables it may be obtained, whatever may be its form, its age, or its state of aggregation, has always the same chemical constitution: its conversion into dextrine by diastaso sulphuric acid, potash, &c., are modifications of its physical properties, without in the least degree altering its chemical constitutton, which is represented by $C^2$ $H^5$ $O^5$

*To remove Fruit and Wine Stains.*—Put about a table spoonfull of muriatic acid into a teacup and add about a teaspoonfull of powdered manganese, then set the cup in a large one filled with hot water, moisten the stain with water, and expose it to the fumes that rise from the teacup. If the exposure be continued a sufficient length of time the stains will disappear. This solution can only be applied with safety to white goods, as it discharges all printed and dyed colours.

J. R. w.

*To make a beautiful Green Paint.*—Add to a hot solution of sulphate of copper, (blue vitriol) a little solution of carbonate of soda; a beautiful powder (known by the name of French green) will be precipitated. The powder is sub-carbonate of copper. J. R. W.

*To make Cometic, Pearl Powder.*—Dissolve bismuth in nitro-muriatic acid, and gradually add to the solution cold distilled water; upon which a beautiful white powder, which is an oxide of bismuth, will be precipitated.

Digitized by Google

## MISCELLANIES.

*The School of Design* for the Improvement of *Working Men* will be opened on Tuesday next the 1st of August. The hours of attendance will be from Six till Nine o'clock every evening, except Saturdays. Each student will have to pay *Two Shillings* per week, and provide himself with materials for drawing.—Application for admission to be made at Somerset House.

*Prizes of the Institute of Civil Engineers.*—The following subjects have been proposed by the council as those on which they are anxious to receive communications, and for the best papers on which they will award premiums. No distinction will be made between the communications of members or associates, and others in no way connected with the institution, and more than one premium will be awarded if the papers sent in are of sufficient merit. The prizes will not be confined solely to the following list.—1. The Nature and Properties of Steam, considered with reference to its application as a moving power for machinery.—2. Warming and Ventilating Public Buildings and Apartments; with an account of the methods which have been employed most successfully for ensuring a healthy state of the atmosphere.—3. An account and Drawings of the Original Construction and Present State of the Plymouth Breakwater.—4. The Ratio from actual experiment, of the Velocity, Load and Power of Locomotive Engines on Railways; first upon levels, second upon inclined planes.—5. Drawings, Description, and Account of the principles of Huddart's Rope Manufactory, at Limehouse.—6. The Sewerage of Westminster.—7. Drawing and description of the Shield at the Thames Tunnel, with an accurate account of the method by which it is advanced and worked.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Aug. 2, J. Webster, esq., on Geology.—Friday, 4, Professor Calvert, on Elocution and the art of Reading, at half-past eight.

*Aldersgate Street Institution.*—Wednesday, Aug. 2, J. S. Buckinghain, esq., on Palestine, at eight o'clock.

*Eastern Athenæum*, Stepney-green.—Wednesday, Aug. 2, Half Yearly General Meeting, at eight o'clock.

*Saint Pancras Institution*, Colosseum House, New Road.—Tuesday, Aug. 1, General Quarterly Meeting, at half-past eight o'clock.

*Bermondsey Mutual Instruction Society*, British School-room, Great George-street.—Monday, July 31, Mr. Errington, on English Literature, at a quarter past eight o'clock.

*Tower-street Mutual Instruction Society.*—Monday, July 31, Mr. Robinson, on Chemistry, Oxygen and Nitrogen, at half-past eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, Aug. 1, Mr. Saull, on the Influence of Scientific Knowledge in forming the Character of the Future Generations of Mankind, at half-past eight o'clock.

## QUERIES.

### *To the Editor of the Penny Mechanic.*

*Hair Dye.*—SIR,—Can any of your numerous readers inform me what will dye *White* or *Grey* Hairs *Black*, (except the nitrate of silver) without acting as a depilatory; if they can they will confer a favour upon,

CANI CAPILLI.

### ANSWER TO QUERRE.

*Alarums.*—If D. N., in No. 30, will forward his address to the Printer of this Magazine, he may hear of a plan for an alarum that will no doubt answer his purpose, being of easy construction, and having the power of waking without noise, or disturbing others.

N. D.

## TO CORRESPONDENTS.

*It was our intention to have published the* PENNY MECHANIC *in* yearly *volumes; but having of late had many inquiries for complete sets of our work, and numerous objections to keeping a whole twelve-month's* loose numbers, *we are disposed to meet our friends half way, and have therefore come to the determination of completing a volume at the end of* every Nine Months. *The present, then, will be the last Number of the first volume, and in a week or two we will publish a Supplementary Number, containing its Title-page, Index, and Frontispiece. The volume will be neatly bound in cloth, price* 4*s.* 6*d.*, *and, we need not remind our Readers, will be by far the Cheapest Mechanical Work Published!*

C. H. S., on Aerostation, *shall have the paper inserted.*

Rugbœensis. *The Mechanism appears to be simple and ingenious, and we will endeavour to find room for a description of it.*

Mr. E. Ellen's *Translation of M. Latour's Paper on* Vinous Fermentation *shall be published.*

J. G. *on Removing the Stain of* Indelible Marking Ink, *next week.*

A City Prentice. *We have received a similar communication from another correspondent which is already composed. He is thanked for the letter.*

Mr. Wallington. *The notice was intended for him. We are much obliged for the drawing.*

A. M. *We have forwarded the card as he wished to* an Operative Mechanic.

*We are inclined to agree with* A Plain Man, *that the communications of some of our correspondents would receive more attention if they did not use such "curious signatures."*

Received.—W. S.—A Constant Reader.—*and* F. C. P.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# INDEX.


Accidents on the ice, to prevent, 26, 285, 301.
Address, 2.
Aeronautic Society, 136.
Aerostation, 87, 287.
Air-gun, 19.
Alarum, 260, 266, 293, 322.
Aldersgate-street Institution, 312.
Alloy, a fusible, 298; Parkes's, 306.
Alpnach, slide of, 45.
American forests, produce of, 216; sea, produce of, 216.
Apparatus, chemical, 312; medical, 253, 292, 320.
Arches, construction of, 250,
Arithmetical puzzle, 239, 252, 261.
Arnott's elements of physics, 7.
Arsenic, vegetable substance in, 152.
Arts, the fine, 311.
Art, works of admission to, 248.
Associations for working men, 319.
Atmos, the giant, 22, 29, 44.
Atmosphere, pressure of the, 85; state of in London, 160.
Attraction, capillary, 124.
Aurora borealis, 6, 15.

Baths, the national, 131, 282.
Baking, provisions, 266.
Balloon, improved, 226; Mongolfier fire, 218; novel ascent in a, 257; Vauxhall 13.
Bell for churches, 247.
Bell Rock Light-house, 42.
Bees, sting of, 192.
Bellows, wooden, 173.
Biographical notices, 117, 292, 222, 261.
Blood, physiology of the, 53, 83, 134.
Blue lights, to make, 298, 306, 314.
Boilers, steam, 50, 66, 82, 124, 162, 180, 250, 300; explosion, 268, 286, 294; mode of filling, 104.
Boots, to prevent cracking, 176.
Botanical Society, 16, 32.
Brain, the, 70.
Brewing cheap beer, 135; works on, 48.
Brindley, biography of, 212.
British Association, 304.
British Museum, 159.
Busts, engine for copying, 312.

Cabs, new, 247.
Cannon, casting and boring, 284.
Capital, immaterial, 309.
Caoutchouc, 128.
Carmine, to form, 258.
Carriage-door locks, 114.
Cartwright, biography of, 196.
Cement, 72; for china and glass, 208; for rendering joints steam tight, 184.
Chemical recreations, 101 103.
Chemist, the, 305.
Chemistry, objects of, 94.
Charring animal substances, 31.
Chimney, to extinguish fire in a, 16.
Civil Engineers' Institute, prizes of, 322.
Civilization, fruits of, 14.
Clay, contraction of, by heat, 216.
Clement's improved window sash, 165.
Cold, effects of, 56.
Colebrook Literary Institution, 168.
Combustion, 83.
Cowell's sash suspenders, 207, 276.
Comets, 126.
Cotton manufacture, 171.
Crank for steam-engine, 273.
Crosse's extraordinary experiments, 102, 143. 152.

Davenport's electro-magnetic engine, 261, 308.
Davy lamp, 51, 79, 95, 143.
De Caus and Marquis of Worcester, 302.
Decay in timber, 234.
Detrosier's address, 166.
Dew, formation of, 52.
Diamonds, 144.
Diamond, the glazier's, 127.
Digestion, 203, 244, 303.
Diving apparatus, 211.
Divisibility of matter, 150.
Double acting engine, 138.
Douglas's steam boilers, 50.
Drag for mail coaches, 282; for coaches, 309.
Drill, improved pin, 285.
Drowning, to rescue persons from, 26, 285, 301.
Dulwich gallery, 318.

Earth, globular shape of the, 66; heat of the, 126, 242, 263.
Eclipse, lunar, 192; cause of, 214.
Educational Association, 8, 192.
Education of the body, Bray's, 116; anticipated result of, 35.
Electrical apparatus, 253, 292, 320.


Digitized by Google

Electrifying machine, amalgam for, 200.
Electro-magnetic engine, Davenport's, 261.
Engineer's Encyclopædia, 222.
Escapement for watches, 69.
Escapes, fire, 271.
Experiments for Christmas time, 63.
Explosion at Hull, 268, 286, 294.
Explosions of gas, 223.
Eye, the, compared with optical instruments, 106.

Factory women, 238.
Fine arts, 311,
Fire, to preserve property from, 164; to extinguish on board ships, 189.
Fire-escapes, 271.
Fire-proof dress, 271.
Fire-works, 258, 298.
Fishes, scales of, 64.
Fluid resistance, 36.
Force pump, King's, 154.
Friction, 27; in tubes, 297.

Gas, purification of, 40.
Gas cooking apparatus, 114.
Greenwich Railway, 10, 58, 144, 152, 167, 184, 306
Gilding picture frames, 314.
Ginger-beer, to make, 297; powders, 289.
Glass, making window, 87; painting on, 7. stoppers to extract, 96.
Glue, to prepare, 298; for card-board, 128.
Grand Junction Railway, 282.
Grease spots, to remove, 281.
Gregory's escapement for watches, 69; improved balloon, 225; rotary pump, 242.
Governor of steam engine, 147.
Gunpowder, different charges of, 82.

Heat of the earth, 126, 242, 263.
Heights of objects, to find, 47.
Hill's rotary printing machine, 20, 115, 182.
Hood and mouth piece, 210.
Horses v. men, 8.
House of Commons, ventilating, 125.
Human body, the, 11, 53, 83, 203, 244, 303.

Indian rubber solution, 128.
Ink, copper plate, 248: invisible, 108.
Inks, gold and silver, 248; permanent, 290; stains to remove, 258, 281.
Insects, species of, 64.
Intemperance, 179.
Inventions, repertory of patent, 272.
Inventions, rewards for, 256.
Inventors, unfortunate, 276.
Iodine, 321.
Islington cattle market, 292.
Iron, manufacture of, 245; cast, effect of water on, 40.
Iron and steel, Indian method of making, 205.
Ivory, to colour, 274.

Jeffrey's patent respirator, 252.

King's English Grammar, 24.
——— force pump, 154.
——— steam boilers, 66, 162.
Kite carriage, Pocock's, 30, 139, 231.
Knowledge for all, 118.

Labour, division of, 23; economizing, 86.
Lake, colour to form, 258.
Lamp glasses, sudden breaking of, 71.
Lapidary's wheel, Hindoostan, 281.
Lectures, lists of, in each No.; Mr. Chalklen's, 8; Dr. Birkbeck's, 47.
Lever, the, 99.
Light, 155. 147, 254, 276.
Light of the sun and fixed stars, 231.
Lightning conductors, 240, 251, 336.
Liverpool and Manchester Railway, 111.
Living models, 290.
Logarithms, 181.
London and Birmingham Railway, 191, 278, 311.
Lucifer matches, 200.

Machinery, results of, 139, 162, 182, 188. 196.
Manufactures, 186, 198, 206, 213, 245.
Materials of little value, use of, 127.
Matter, properties of, 110; divisibility of, 150.
Mechanics' library, 7, 24, 61, 117, 116. 191, 222; institutions, London, 8. 24. 48, 56, 112, 116, 167, 273, 289, 301; on, 310.
Mechanical powers, the lever, 99; wheel and axle, 170.
Messiah, Mr. Robert, 64.
Meteoric stones, 77.
Meteorological Society, 16. 32, 64.
Meteorology, 47.
Mills, improved water, 268.
Miners' Fund Society, 102.
Models, living, 290.
Monday's safety lamp, 218; sofa bed, 186.
Moon, the, 72.
Morton's improved window sash, 242.
Mutual Instruction Society, 96, 128; Finsbury, 96.

National baths, 131. 282.
Natural history, magazine of, 273.
Natural philosophy, on the study of, 15.
Natural philosophy, works on, 128.
Needle making, 186, 198.
Newton, Sir Isaac, 69.

Oil for delicate machinery, 184.
Oil gas, 92.

Digitized by Google

Paint, green, to make, 321.
Painting on glass, 206, 213.
Parachute, Cocking's, 312.
Patents, English, list of, 256, 296; Scotch, 257, 296.
Patent, a curious, 24.
Patents in America, 183.
Patent law, 91, 156.
Parkins on railways, 103.
Patterson's carriage lock, 114.
Paupers in Paris, 40.
Pearl powder, 321.
Peripurist, patent, 210.
Permanent ink, 290.
Perpetual motion, 27, 59, 159, 183, 190, 199, 245, 260, 292.
Phenomena, natural 4, 52, 77, 214.
Philosophical journals, 230, 271.
Phosphorescence of the sea, 60, 86.
Physical sciences, Somerville's, 117.
Picture frames to gild, 314.
Plants growing downwards, 211.
Plough, steam, 176, 223, 296.
Pocock's kite carriage, 30, 139, 234.
Polishing powder, 234.
Practical knowledge, 167.
Printing machine, Hill's rotary, 20, 115, 182. press, Woods, 96.
Prizes, Institute of Civil Engineers, 322; Society of Arts, 71.
Producing man's companion, 191.
Puttich's steam boiler, 124.

Queries in each No.
Quill-making, 216, 306.

Radish, 72.
Railways, 43, 75, 118, 194; Parkins on, 103; statistics of, 200; construction of, 215.
Railway, Grand Junction, 282; Greenwich, 10, 58, 144, 152, 167, 184, 306; Liverpool and Manchester, 111; London and Birmingham, 191, 278, 311; tunnels, 278.
Rain, cause of, 4.
Reflectors for gas, 150.
Respirator, Jeffrey's patent, 252.
Retarder, the patent, 31.
Ritchie's perpetual motion, 159.
Robert's hood and mouth piece, 210.
Rotary pump, 242.
Royal Academy students, 266.
Rust, to prevent, 160.

Safety lamp, 51, 79, 95, 143, 285; Monday's, 218.
Saint Monday, 293, 318.
Sap, rise of the, 37, 54.
School handicraft at Moscow, 39.
School of design, 54, 144, 247, 295, 322.
Scientific journals, 230, 271.
Sea, phosphorescence of, 60, 86; red coloured, 232, 265.
Shipwrecks, 85, 115, 141, 277.
Shoes and gloves, 266.
Shot, manufacture of, 112.
Skating, 112; land, 154, 174, 183.
Snap-dragon, 8, 63.
Sofa bedstead, Monday's, 184.
Society of Arts prizes, 71.
Specific gravity, 112, 128.
Spirits of wine, 189.
Square, to find diagonal of a, 60.
Stains of fruit and wine, to remove, 321.
Starch, constitution of, 321.
Steam boilers, 50, 66, 82, 124, 162, 180, 250, 300; mode of filling, 104; conveyance, advantages of, 132, 143;
Steam engine, 31; Branca's, 122; crank, 273; De Caus's, 18; Dr. Lardner on the, 61; Savery's, 74, 122; Marquis of Worcester's, 34; Watt's, 269; history of, 5, 18, 67, 74, 122; high pressure, 2; power of, 16; plough, 176, 223, 296; gun, 111.
Straw weaving, 192.
Sugar, manufacture of, 55.
Sun, effect of, on fire, 208.

Tanning, 127.
Taylor, James, biography of, 261.
Tee-totalers, 266.
Temperature of the earth, 126, 242, 263.
Temperature of Greenland, 231.
Tracing paper, to make, 240.
Tree, a large, 208.
Tunnels, railway, 278.
Tunnel, the Thames, 176, 265.

Unhealthy trades, 218, 228.
Universe, immensity of the, 118.

Ventilation of steam boats, 253.
Verulum Society, 297.
Vitality of seeds, 120.

Warming rooms, 46, 123.
Wasp stings, to cure, 191.
Watch, mechanism of a, 130, 146.
Watch towers at Dover, 90.
Water, greatest heat of, 8; to form fresh from salt water, 264; mills, 288.
Water-proof cloth, 258.
Weavers, the, 289.
Wheel and axle, 170.
Wood's printing press, 98.
White on railways, 43, 75, 118, 194.
Window sash suspenders, improved, 165, 207, 242, 276.
Windmill, power of, 8.
Woolf's steam boiler, 82.
Worcester, Marquis of, and De Caus, 302.
Working classes, improved condition of the, 148, 154, 175; increased temperance of, 38.
Working Men's Association, 319.
Writing, to revive old, 8.

Zoological Institution, the Kent, 294.
Zoological Society, 16, 144.

Digitized by Google

# LIST OF ILLUSTRATIONS.


1. Frontispiece.
2. The Advertiser.
3. High Pressure Engine.
4. The Greenwich Railway.
5. De Caus Steam Engine.
6. The Air Gun.
7. Section of same.
8. Apparatus for rescuing Drowning Persons.
9. Diagram of same.
10. The Marquis of Worcester's Steam Engine.
11. Bell Rock Light House.
12. Section of same.
13. Diagram to find the Height of Objects.
14. Douglas's Steam Boiler.
15. Section of same.
16. The Safety Davy Lamp.
17. Opening of the Greenwich Railway.
18. King's Steam Boiler.
19. Diagram of same.
20. Gregory's detached Escapement for Watches.
21. Savery's Steam Engine.
22. Diagram of Railway Inclined Plane.
23. Another Diagram of same.
24. Woolf's Steam Boiler.
25. Woolf's Furnace.
26. Ancient Watch Tower at Dover.
27. Wood's Atlas Printing Press.
28. Lever of First Order.
29. Lever of Second Order.
30. Lever of Third Order.
31. Mode of filling Steam Boilers.
32. Patterson's Carriage Lock.
33. Gas Cooking Apparatus.
34. Diagram of Patterson's Carriage Lock.
35. Diagram of Levelling Railways.
36. The same.
37. Section of Savery's Steam Engine.
38. Branca's Steam Apparatus.
39. Puttich's Improved Boiler.
40. Spring and Barrel of a Watch.
41. Scapement of same.
42. Another form of Scapement.
43. Second and Minute Wheels of a Watch.
44. Minute and Hour ditto.
45. Double Acting Engine Valves.
46. Mechanism of a Watch complete.
47. The Governor of a Steam Engine.
48. A Perpetual Motion.
49. King's Force Pump.
50. King's Improved Steam Boiler.
51. Clement's Improved Window Sashes; Five Drawings.
52. Wheel and Axle.
53. Diagrams to illustrate same.
54. The Atmospheric Steam Engine.
55. Monday's Sofa Bedstead.
56. Illustration of a Railway.
57. Two Diagrams of Moveable Rails.
58. Turning Plate.
59. Section of same.
60. Steam Carriage Wheels
61. Two Sections of Rails.
62. Islington Cattle Market.
63. Ground Plan of same.
64. Robert's Hood and Mouth Piece.
65. The Patent Peripurist.
66. Section of same.
67. Gregory's Improved Balloon.
68. Valve for same.
69. Pocock's Patent Kites.
70. The Charvolant.
71. Gregory's Rotary Pump.
72. Rivet for Spring of ditto.
73. Morton's Improved Window Sash.
74. Three Diagrams for constructing Arches.
75. Cheap Electrical Apparatus.
76. A Simple Alarum.
77. Steam Boiler Explosion at Hull.
78. Eight Illustrations of Cowell's Patent Sash Suspenders.
79. Method of Boring Cannon.
80. Machine to rescue Drowning Persons.
81. An Improved Safety Lamp.
82. An Improved Pin Drill.
83. Cheap Electrical Apparatus—a Cylinder.
84. Rubber for ditto.
85. Apparatus to fix same.
86. Stand for same.
87. Cheap Electrical Machine complete.
88. A Perpetual Motion.
89. An Improved Alarum when set.
90. The same when gone off.
91. Section of a Steam Boiler.
92. Diagram of same.
93. Apparatus to rescue Drowning Persons.
94. Davenport's Electro-magnetic Engine.
95. Diagram of same complete.
96. An Improved Coach Drag.
97. The Vauxhall Balloon.
98. Mr. Cocking's Parachute.


Digitized by Google

Digitized by Google

JAMES WATT ESQR.

F. R. S. &c. &c.

LONDON.

Published by G. Bryer for the Hon.ble Mechanic & Chemist

VOL. II.

Digitized by Google

THE

# PENNY MECHANIC;

## A MAGAZINE

OF THE

## ARTS AND SCIENCES.

VOL. III.—1837-8.

**WITH NUMEROUS ILLUSTRATIONS.**

LONDON:

PUBLISHED BY D. A. DOUDNEY,

AT THE HOLLOWAY PRESS;

BERGER, HOLYWELL-STREET, STRAND;

AND MAY BE HAD OF ALL BOOKSELLERS.

Digitized by Google

HOLLOWAY PRESS:
D. A. DOUDNEY.

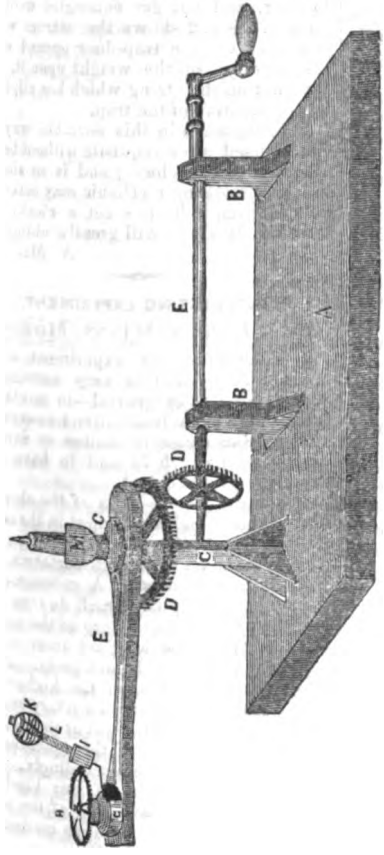
Digitized by Google

# THE PENNY MECHANIC,

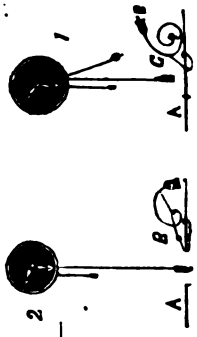
## AND THE CHEMIST.

No. XLI.] SATURDAY, AUGUST 5, 1837. Vol. II.

CHEAP ASTRONOMICAL APPARATUS.—Fig. 1.




ALARUM.




A CURIOUS EXPERIMENT.

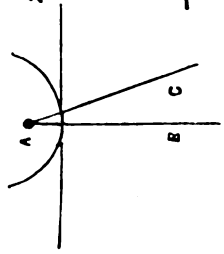
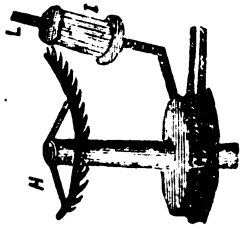



Fig. 2.






Holloway Press: D. A. Doudney.

Digitized by Google

## CHEAP ASTRONOMICAL APPARATUS.

*To the Editor of the Penny Mechanic.*

SIR,—I beg leave to offer to your readers the description of a machine which illustrates the motion of the earth round the sun, and on its own axis, together with the inclination of its axis to the plane of its orbit, the vicissitudes of day and night, and of the seasons. Fig. 1 shows the whole machine; and fig. 2 is the enlargement of one part of it, to illustrate its construction more clearly.

On the frame A fix three uprights C, B, D, as in fig. 1, and let the perpendicular wheel D (with a long spindle E to turn in sockets in B B) play into the corresponding horizontal wheel D, having the arm F fixed on it, so as to turn with it. On the part of the upright C which projects beyond the arm F, fix the pulley G, and a corresponding pulley G on the other extremity of the arm: this last pulley is to move on its axis, which must terminate in the stationary wheel H. Let the spindle L fall on the pulley G at an angle of 45 degrees, having a pinion I playing into the teeth of the wheel H: the pinion I must have an arm to fit into a small globe K (revolving on the top of the spindle L as in figure), which represents the earth. A socket M may be placed above the other pulley to receive a candle which represents the sun. The working of the machine will now be obvious.

The wheels D D being turned by a winch as in figure, the arm F is turned with them; and the effect of the pulleys will be always to preserve the earth's parallelism, while the pinion I playing against the circular rack-work H, will turn the earth on its axis a sufficient number of times to show the motion.

The whole can be made at a slight expense.

I remain, &c.,

RUGBŒENSIS.

## AN ALARUM.

*To the Editor of the Penny Mechanic.*

SIR,—Reading Number 37 of your useful little work, I perceive a description of an alarum as being more simple than the one formerly described. I admire the simplicity of it certainly; but I should like (if permitted) to point out an alteration, which, I have no doubt, you will think an improvement. Instead of the bell being hung up high, and the cord passing over the clock, as Mr. Gredley's simple alarum is described; which, by the jerk of the cord, is liable to shake the clock, and throw it out of beat; or the string might catch the pendulum and stop it outright. If any of your numerous readers should be induced to make one of these alarums, I should advise them to make it as I shall describe.

Fig. 1 represents the alarum set: A is a piece of board with trap-door in it, B is a common house-bell mounted on the board, C is a string attached to the bell with a knot (which is more simple than a wedge) far enough from the bell to reach the trap door when set, with another knot at the end secured to the board, the string left long enough to allow the bell to ring, and not get entangled with the weight. Fig. 2 shows the alarum when gone off: A is the trap-door opened with the pressure of the weight upon it, B is the knot on the string which has slipt off by the opening of the trap.

It being made in this portable way, it can be used when requisite without being attached to the clock; and is so simple that any working mechanic may make his own alarum, if he has got a clock. By inserting this you will greatly oblige,

A MECHANIC.

## INTERESTING EXPERIMENT.

*To the Editor of the* PENNY MECHANIC.

SIR,—The following experiment is not much known, and is very amusing to young persons in general—to mechanics it may afford an instructive lesson in examining the cause of motion so extraordinary, and which is said to have been discovered by accident.

Procure a watch-glass of the cheapest kind, those which are highest in the centre will answer best. Place the convex side of the glass on a smooth surface a little wet, but not greasy. A common plate turned bottom upwards will do very well, and the use of the moisture on the plate is to keep the watch glass from sliding when the plate is held obliquely. If the watch-glass be kept on the higher part of the plate it commences a rotary motion, either turning to the right or the left, according to the will of the operator, by his leaning the plate accordingly. If a few dots or figures of any kind, are painted on the concave side of the watch glass, the appearance while in motion will be improved.

The cause of motion in this experiment I take to be as follows. In the diagram, let A be the centre of gravity of the watch-glass, and A B the line of direction, as it will be when the plate is held in a horizontal position; but if the plate be inclined so that A C, becomes the line of

Digitized by Google

direction, then the centre of gravity not being supported, the watch-glass will have a tendency to roll, or shift the point of contact with the plate, towards the line AC, leaving the largest half of the watch-glass in the direction of the highest part of the plate. And as the glass cannot slide down the plate, it commences a rotary motion which will carry it to the lowest part, but may be kept in motion as long as the operator pleases, by changing the position of the plate so as to keep the glass upon the higher part of it.

PHILO.

## ACCIDENTS IN MINES.

THE following Petition of Mr. John Cooper Douglas which was presented by Mr. Pease, M. P., to the House of Commons, has been forwarded to us, and from it we extract the following passages. The Petitioner after referring to the Select Committee appointed to enquire into the subject, states, that it was adduced in evidence before the said Committee, in which the witnesses agreed, that the dangerous part of the working of a colliery generally commences with working or taking away the pillars, and that the mine is then placed under circumstances beyond control, so far as ventilation goes, inasmuch as the workings where the pillars have been removed, cannot be ventilated; and that it does not signify what force of ventilation may be had, if it cannot be applied to dislodge the gas; and that until some effectual plan can be devised for dislodging and expelling the gas entirely and effectually from those lodgements in vacant spaces occasioned by working the pillars, the chief cause of all the accidents will remain unabated.

That the Petitioner after having for a considerable period bestowed much of his time and attention to the consideration of the causes of explosions and accidents in coal mines, and the means of avoiding them, has discovered an effectual plan, as well for the collection of the gas generated in coal mines, and the application thereof to numerous useful purposes, as for ventilating, lighting, and working mines, and improving the machinery employed therein; by which the evils complained of will, in the opinion of your Petitioner, be entirely removed, and the destruction of life and property now frequently occurring, be wholly prevented. And your Petitioner has accordingly obtained His Majesty's Royal Letters Patent, for his said discoveries.

That the introduction of your Petitioner's improvements into coal mines will not only effectually remove the obstructions which at present arise in the working of mines from the accumulation of gas in consequence of their imperfect ventilation, but also, by allowing such portions of the pillars as are now usually left to be worked or taken off, will enable the entire quantity, or one hundred per cent. of coal to be wrought in every mine instead of forty-eight, or at most sixty-three per cent., which, according to the evidence taken before the said Committee of your honourable House, is the quantity of coal obtained under the present system; thus ensuring perfect safety to the miners, and at the same time causing a saving or gain to the coal proprietors of from thirty-seven to fifty-two per cent. in their coal.

That, in addition to the grand desideratum above described, your Petitioner sincerely believes that the following advantages will also result from his discoveries, should the same be carried into effect, viz.,

First. By the application of an apparatus described in the specification to your Petitioner's patent, a power will be obtained in the process of ventilating coal mines, capable of pumping up the water and gas which collect therein, and of raising the coals, and doing other things requiring great mechanical power.

Secondly. Another and effective power may be obtained under the same patent, by collecting the pure hydrogen gas from the blowers, and combining it with certain portions of oxygen gas, which being ignited in a close vessel, are converted into water, whereby a vacuum is produced, and a power obtained equal to a condensing steam engine.

Thirdly. By means of a lamp adapted for burning in coal mines, the gas, which has hitherto been the cause of so much loss of life and property, may be applied to the purpose of safely and more economically lighting the mines; thus for the most part rendering it unnecessary for the miners to carry about with them naked lights or lamps of any kind.

Fourthly. By means of an apparatus described in your Petitioner's specification, the gas generated in coal mines may be collected and usefully employed in the adjacent cities and towns, and may also be compressed to such a degree, as to make it portable at a very trifling expense, thereby rendering it applicable, in place of coal, to many useful and valuable purposes.

Fifthly. Your Petitioner has also dis-

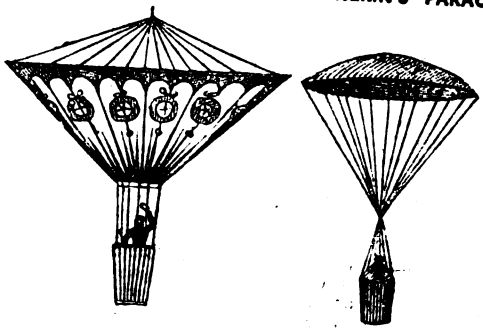
Digitized by Google

covered an improved safety lamp, described in your Petitioner's specification, which, from its construction, is not liable to become red hot even in a stream of gas; nor will it ignite the external atmosphere, although carried into a rapid current of air.

That, considering that the collecting of the gas generated in the coal mines of Great Britain and Ireland, which is now wholly lost, and the application of it to useful purposes as proposed by your Petitioner, would, if carried fully into effect, produce annually a large source of wealth and industry to the State, and that it is expedient, on the grounds of humanity, that your Petitioner's invention should be introduced into all mines, under some legislative regulation, your Petitioner is willing to place his said patent at the disposal of Parliament for the benefit of the nation, for such reasonable remuneration, as he may be considered fairly entitled to.

JOHN C. DOUGLAS.

COCKING'S PARACHUTE. GARNERIN'S PARACHUTE.



## DESCENT OF GARNERIN'S PARACHUTE IN 1802.

IN this age of ballooning, and at a time when the fatal experiment of Mr. Cocking forms a subject of general conversation, we think the following account with which we have been favoured of M. Garnerin's descent in a parachute in 1802, as given in his own words, cannot fail to be acceptable.

The parachute used by Garnerin on the occasion of his ascension in London, on the 21st of September 1802, was of cotton, and expanded in the manner of an umbrella. At the top of it ran round a hoop eight feet in diameter. In this part also was a circular aperture, where the cylinder terminated the cord by which the parachute was to be fastened to the balloon. The sides of the parachute, when it was expanded, were about fifteen feet long, and formed a sort of curtain. Garnerin placed himself, with a flag in his hand, in the basket suspended from the parachute. The cords by which this basket was fastened to the cotton stuff were tied just above his head in a knot, and from this knot ran cords to the extremities of the cotton. The cords and basket were about twenty feet long, reckoning from the end of the stuff. This parachute, which was attached to the balloon, hung at a considerable distance beneath it. As the balloon rose, the parachute followed, and it was impossible to view the aeronaut dangling in it at such a prodigious height without shuddering. At length Garnerin cut the cord by which the parachute was fastened to the balloon. At this sight many of the spectators were filled with the greatest alarm, fearing lest they should see him fall every moment. The balloon rose with extraordinary velocity, and the parachute descended with equal rapidity for half a minute, and then sunk slowly to the earth. As there was not sufficient ballast in the parachute, Garnerin swung backward and forward like the pendulum of a clock, but with much greater violence; at length he alighted in safety.

The following is Garnerin's account:—

The experiment of my 31st ascent, and of my fifth descent in a parachute, took place on a very fine day, and in the presence of an immense crowd of spec-

Digitized by Google

tators, who filled the streets, windows, houses, and the scaffoldings erected round the place of my departure, which, alas! was the only spot not crowded with spectators." [The price of admission to St. George's-parade, North Audley-street (the place from whence M. Garnerin ascended) was 5s., but the money taken did not amount to 180*l.*, so that M. Garnerin must have lost considerably by his adventure. The cause is easily accounted for: curiosity is much better gratified by being at a distance from the ascent of a balloon. Persons of the first distinction, however had assembled on the ground, particularly the Earls Camden and Stanhope, Sir Francis Burdett, Mr. and Mrs. Sheridan. &c.]

"It is necessary, when I undertake the experiment of the parachute, that I should know the state of the atmosphere, in order to enable me to judge of the course I am to take, and also to adopt the proper precautions to insure success. About three o'clock in the afternoon I had the satisfaction of having a first indication from the agreeable effect of a very pretty Montgolfier balloon, which was set off from the environs of St. George's-parade, and which took a direction over Marylebone-fields.

"The success of this experiment ought not to prevent me from expressing my opinion of the danger that may result to the general safety from the daily abuse of those night experiments which are not always directed by persons conversant with the subject. One shudders to think that a machine of this kind may fall, and fall on fire, upon the cordage of a ship, and thus involve in a great conflagration all that constitutes the wealth of one of the first cities of the world. The use of these machines was prohibited in France, and the Consular Government confided to me alone the direction of night balloons, which I conceived and introduced into the national fêtes.

"Convinced of the direction of the winds, I hastened the filling of the balloon, and at 5 p.m. I filled the pilot balloon, which Mrs. Sheridan did me the honour to launch. It seemed to me that I was conciliating the favour of Heaven by the interference of the Graces. This pilot balloon ascended quickly, and was soon out of sight, marking my career towards the north-east. While the anxious crowd were following the path of my little pilot, I suspended the parachute to the balloon; this painful and difficult operation was executed with all possible address, by the assistance of the most distinguished personages. The parachute was gradually suspended, and the breeze, which was very gentle, did not produce the least obstacle. At length I hastened to ballast my cylindrical bark, and to place myself in it—a sight which the public contemplated with deep interest; it seemed, at the moment, as if every heart beat with unison: for, though I have not the advantage of speaking English, every one understood my signs. I ascertained the height of the barometer, which was at 29½ inches. I now pressed the moment of my departure, and the period of my fulfilling my engagements with the British public. All the cords were cut; I rose amidst the most expressive silence, and, launching into infinite space, discovered from on high the countless multitude that sent up their sighs and prayers for my safety. My parachute, in the form of a dome over my head, had a majestic effect. I quickened my ascending impulse, and rose through light and thin vapours, when the cold informed me that I was entering into the upper region. I perceived I had reached the extremity of the city, and that immense fields and meadows offered themselves for my descent; I examined my barometer, which I found had fallen 43 inches; the sky was clear, the moment favourable, and I threw down my flag, to endeavour to show to the people assembled that I was on the point of cutting the cord that suspended me between heaven and earth.

I made every necessary disposition, prepared my ballast, and measured with my eye the vast space that separated me from the rest of the human race. I felt my courage confirmed by the certainty of my combinations being just. I then took out my knife, and with a hand firm, from a conscience void of reproach, and which had never been lifted against any one but in the field of victory, I cut the cord. My balloon rose, and I felt myself precipitated with a velocity which was checked by the sudden expansion of my parachute. I saw that all my calculations were just, and my mind remained calm and serene. I endeavoured to moderate my gravitation, and the oscillation which I experienced increased in proportion as I approached the breeze that blows in the middle regions; nearly ten minutes had elapsed and I felt that the more time I took in descending, the safer I should reach the ground. At length I perceived thousands of persons, some on horseback, and others on foot, following me, all of whom encouraged me by their wishes, while they opened their arms to receive me. I came near the earth, and after one bound, I

Digitized by Google

landed, and quitted the parachute, without any shock or accident. The first person that came to me pressed me in his arms; but, without losing any time, I employed myself in detaching the principal circle of the parachute, anxious to save an instrument that so well guaranteed me; but a crowd soon surrounded me, laid hold of me, and carried me in triumph, till an indisposition, the consequence and effect of the oscillation I had experienced, obliged the procession to stop. I was then seized with a painful vomiting, which I usually experience for several hours after a descent in a parachute. The interval of a moment permitted me to get on horseback; a numerous cavalcade approached to keep off the crowd, whose enthusiasm and transports incommoded me not a little. The Duke of York was among the horsemen, and the procession proceeded with great difficulty in the midst of the crowd, who shouted forth their applause, and had before them the tri-coloured flag which I had thrown down, and which was carried by a member of Parliament. Among the prodigious concourse of persons on foot I remarked Lord Stanhope, from whom I received the counsels of a scientific man, and who penetrated through the crowd to shake hands with me. "GARNERIN."

According to M. Garnerin's calculation, he had been to the height of 4,154 French feet. The balloon fell on the next day, near Frindsham-mill, three miles beyond Farnham, in Surrey.

Much wonder was excited by the first ascension of a man in a balloon; but surely the descent of a man from an exalted balloon to the earth, without harm, is far more wonderful; it is, however, an experiment as daring as it is terrific.

---

Madame Garnerin, the daughter, we believe, of the celebrated Garnerin, has announced her intention to make a descent in a parachute, in the vicinity of the Parisian metropolis, in the course of the ensuing week.—*Times.*

---

## GALVANISM.

*Sketch of the Science of Galvanism:*—It was accidently discovered by Galvani an Italian, that if the crural nerve and the muscles of the leg of a recently-killed frog be laid bare, and we place a piece of zinc upon the nerve, and a piece of copper upon the muscle, and make the two metals, while so placed, touch each other, the leg of the frog is immediately thrown into violent convulsions. Volt, a friend of Galvani's, invented the pile and showed that shocks like those produced by electricity could be received from it. Shortly after it was found that water, and many other substances could be decomposed by the galvanic energy. It was next discovered that when compound bodies are decomposed, oxygen and acids accumulate round the positive pole, while hydrogen, alkalies, earths, and metals accumulate round the negative pole. Hence it was deduced that chemical affinity is identical with electrical attraction, and that the reason that oxygen combines with hydrogen, and acids with alkalies, earths, and metals, is that they are in opposite states of electricity. Galvanic electricity when properly excited and directed is sufficiently powerful to decompose any compound whatever, and even pure gold may be burned by being made to form a part of a galvanic circuit. We will now proceed to exhibit some of the effects produced by galvanic action. 1. Place a piece of metal zinc under the tongue, and a piece of copper (as a penny) upon the tongue, and bring the extremities of the metals into contact, the result will be the immediate perception of a curious taste, something resembling the taste of copperas. The metals have not this taste when not in contact; and, therefore, this experiment clearly shows the influence of excited galvanic electricity upon the organ of taste. 2. Moisten the under lip, lay upon it a shilling with the edges of it beneath the tongue, lay upon the tongue a piece of zinc, and bring the edges of the pieces of metal into contact—instantly the shilling will feel so intolerably hot that you will be obliged to let it fall from your mouth. You will then not hesitate to say—galvanic electricity has an influence over the sense of feeling. 3. Place a piece of zinc under the tongue, and put the small end of a silver tea-spoon in the mouth, between the teeth and the under-lip, passing it up as high as possible, and pressing the extremity of it against the gums, then let the lower part of the spoon touch the edge of the piece of zinc—at the moment of contact a flash like lightning appears to the eye, which is renewed as often as you let the two metals touch each other. If you shut your eyes when you perform this experiment, you still see the light, and if you look sternly at a candle or other light, still you see it. Does not this afford ocular demonstration that galvanic electricity effects the organ of sight. 4. If a piece of silver and a piece of zinc have one extremity immersed in the same vessel containing sulphuric or muriatic

Digitized by Google

acid, largely diluted with water, the zinc is dissolved and yields hydrogen gas by decomposition of the water, the silver not being acted upon has no power of decomposing the water; but whenever the zinc and silver are made to touch, or any metallic communication is made between them, hydrogen gas is also formed at the surface of the silver. 5. Take a solution of sulphate of copper (blue vitriol) immerse a piece of silver in it, it will come out unchanged, immerse a piece of polished iron—it will receive a coat of copper, bring the iron and silver into contact and immerse them in the solution together—then both will be coated with copper.

J. R. Watts, M. D.

# THE CHEMIST.

## VINOUS FERMENTATION.

*To the Editor of the* Penny Mechanic.

*Lieuw, Normandy.*

Sir,—I have before me an abstract of the proceedings of the French Academy of Sciences at their sittings of the 19th of June last. There is one communication on the subject of Vinious Fermentation which appears to me novel and curious. Perhaps it may be equally so to you or your readers, I will therefore translate the notice in question, to be inserted, or not, according to your opinion of its value.

"Monsieur Cogniard Latour announced that in the researches which he had undertaken on this subject, he had deviated from the mode of investigation ordinarily followed by chemists who had already occupied themselves with the subject of Vinious Fermentation, and that he had chiefly applied himself to study, with the aid of the miscroscope, the phenomena upon which this fermentation depends.

After having detailed in his paper, the various observations he had made by this means, he gave the following result of his researches:

1. That the yeast (*levure*) of beer is a mass of small globular bodies, *capable of reproducing themselves*, and, consequently, *organised*, and not an inert and purely chemical substance, as people have hitherto supposed.

2. These bodies appear to belong to the vegetable kingdom, and to reproduce themselves in two different ways.

3. They appear to act on a solution of sugar only as long as they are in a state of life, whence it is a probable conclusion that it is by some effect of their vegetation that they disengage the carbonic acid from the solution, and convert it into a spiritous liquor. "I would also remark," added M. Cognicard Latour, "that yeast considered as an organized material, merits the attention of physiologists in these particulars.

1. That it is produced and developed under certain circumstances, with great celerity, even in the midst of carbonic acid, as in the vats of Brewers.

2. That its mode of regeneration presents peculiarities of a kind which have never been observed with regard to other miscroscopic objects composed of isolated globules.

3. That it does not perish in severe cold, nor from the privation of water."

I regret, Mr. Editor, 'that I have not the means of furnishing you with some details of this curious discovery; but such as I have found, is at your service.

E. A.

*Marsei Metal, or Crystallised Tin.*—Clean a piece of tin from dirt or grease, by well washing it with warm soapy water, and rince it in clean water; then heat the tin to the temperature of bare sufferance to the hand, and pour on it, or apply with a brush or sponge, one of the following mixtures:—1, dissolve two ounces of common salt in four ounces of water, and add one ounce of nitric acid.—2, to two ounces of water add half an ounce of muriatic acid, and one fourth of an ounce of sulphuric acid.—3, either of the preceding in a greater or less degree of dilution. When the mixture has been applied, the tin is to be dipped into water slightly acidulated, and afterwards well washed in clean water. This process will cause the tin to assume an appearance of great beauty, and apparent crytsallization takes place, somewhat resembling mother-of-pearl, and curious figures, stars, and rude leaves appear. A transparent varnish, either coloured or colourless, may be laid on now which will give a fine polish to the work, and produce that brilliant covering so much employed for snuffer-stands, for covering pillars in shop-windows, &c. J. R. W.

*Imitations of Medals and Seals in Sulphur.*—Melt the sulphur and pour it into water. It then becomes soft and waxy, and can be made to take very exact impressions, from medals.

Digitized by Google

*Elopements by Steam.*—The Preston and Glasgow Railway passes through Gretna Green; and a journey to that place and back to London may be performed without inconvenience the same day. What perhaps is of greater importance to parties who adopt this plan of entering the holy state, they are sure not to be overtaken when once on the railway, as the trains cannot pass each other on the same line.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Aug. 9, T. Webster, esq., on Geology.—Friday, 11, John Hemming, esq., on Chemistry, at half-past eight o'clock.

*Aldersgate Street Literary and Scientific Institution.*—Wednesday, Aug. 9, J. S. Buckingham, esq., on Palestine, at eight o'clock.

*Eastern Athenæum.* — Wednesday, Aug. 9, G. Francis, esq., on Botany, at eight o'clock.

*Saint Pancras.*—Tuesday, Aug. 8, Dr. R. D. Thompson, on Food and Digestion, at half-past eight o'clock.

*Westminster Mechanics' Institution*, 5, Little Smith Street.—Thursday, Aug. 10, W. Maughan, esq., on the Steam Engine, at half-past eight o'clock.

*Bermondsey Mutual Instruction Society*, British School-room, Great George-street. — Monday, Aug. 7, Mr. T. Cousins, on Electricity, at half-past eight o'clock.

*Tower Street Mutual Instruction Society.*—Monday, Aug. 7, W. D. Saull, esq., on the Influence of Scientific Pursuits in Forming the Character of the Future Generations of Mankind, at half-past eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, Aug. 8, Col. Thompson, on Political Economy—the Currency, at half-past eight o'clock.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Prince Rupert's Drops.*—Sir, Can any of your correspondents inform me in what manner those little glass globules are made which burst with a sharp noise when they are scratched, or a portion broken off. They are, I think, called "Prince Rupert's Drops." Yours, obediently, G. L. T.

Sir,—Can any of your correspondents inform me how to harden wire that has been burnt. L. W.

*Colouring Glass.*—Sir, I should be very much obliged if any of your correspondents would inform me of the best method to prepare copper in the way it is used in general for colouring glass. W. S.

Sir,—I shall feel much obliged if you, or any of your correspondents can inform me how copper and iron articles are tinned. Yours, &c. A. Z

Sir,—I shall feel obliged to any of your correspondents who will inform me of the best method of suffling and preserving fish: also the best place for purchasing the eyes. Yours, &c., Walton.

Sir,—It will greatly oblige me if you, or any of your correspondents, will inform me of the best method of preparing the colour for, and painting candle-light scenery, and also the kind of canvass best adapted for the purpose.—The insertion of this will oblige your well-wisher and subscriber,

H. Wells.

ANSWERS TO QUERIES.

*Gilding Picture Frames.*—The process for re-gilding picture-frames, that "Z." has given in No. 39, you will allow me to say, is incorrect: such a process might do for sculpture, but not for wood frames. So many layers of white paint, size, yellow ochre, Armenian bole, blood-stone, black-lead, and fat, &c. &c., would fill up all the cavities of the ornaments, and almost fill the grooves of the mouldings. To lay gold upon an oiled frame with water is wrong, the fat would work through and cause the gold to rub off; but to gild a frame in oil that has been gilt in water is easily done, as I shall show. "Z." advises shell gold to mend the defects. It would cost more for shell gold to mend the defects of a leaf-gilt frame than you might buy a perfect one outright for. I should advise your correspondent to give his frames to a gilder at once to be done, for the saving of expense would not pay him for his trouble. But perhaps it is amusement he wants, like many amateur mechanics; in that case I will give the best methods I can.

To regild in water gold, take a sponge and some clean water and wash the frame well; that done, let it dry: procure some water gold-size, from any artists' colourman; then make some thin size from dry hide or parchment; mix enough warm (not hot, it may cause it to crack) with the gold-size to enable you to work it on the frame with a camel-hair brush: give it two layers; when dry rub it over with a piece of fine sand-paper; it will then be ready for gilding. The gold should be turned out upon a cushion, and cut with a gilder's knife into agreeable shapes; but persons not accustomed to handling leaf gold might make a bungle of it, I would therefore advise him to lay it on thus: get a gilder's tip where you get your size (it will cost 3d.), wet with clean water the frame where you are going to lay your gold on, and with a camel pencil, first drawing the hairs of the tip across your face, to make the gold adhere enough to lift it to the frame, draw the gold into all the cavities. When the frame is covered, rest it on its edge to drain; when perfectly dry, dip your pencil into water, and press it between your lips, partly dry, and wipe the gold over with it; it will take the particles of gold off and make it appear solid. Any parts not being covered, take bits of leaf, with a dry pencil, and lay it on as before; that done give it a coat of clear parchment size; brush the back edges over with some ochre and size; the frame is then ready for use.

A Mechanic.

## TO CORRESPONDENTS.

C. H. S. *Silver sand. It must be quite dry.*

F. C. P. *next week.*

S. J. Cooper's *paper will most probably be made serviceable.*

G. G. *Communications for the prizes of the Institute of Civil Engineers, noticed in our last Number, must be forwarded to the Institution, 1, Cannon Row, Westminster, on or before the 31st of March 1838.*

*The letter of* One of the unwashed—Operative Mechanic—*and Communications from several other Correspondents respecting a Mechanics' Institution shall receive an early attention.*

*We are much obliged to* C. Y. *for forwarding us the list of lectures.*

Working Men's Associations *next week.*

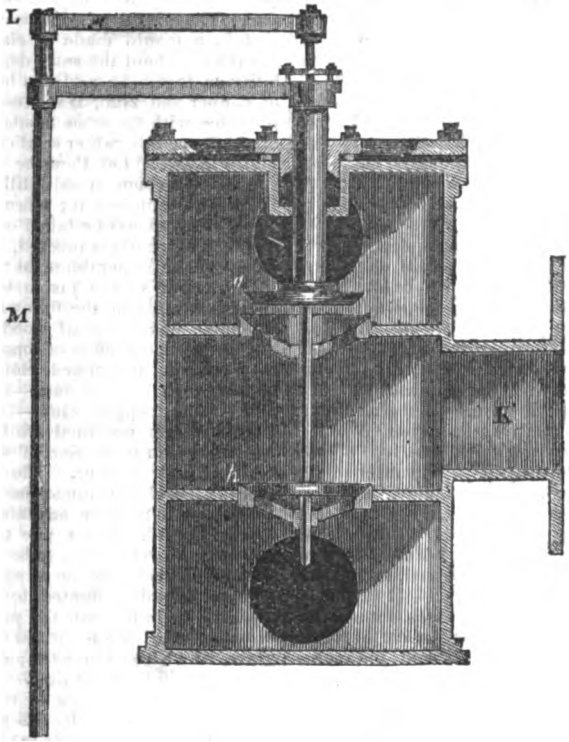
London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

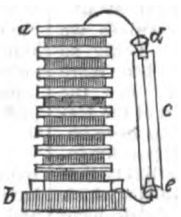
No. XLII.] SATURDAY, AUGUST 12, 1837. Vol. II.


### CONICAL VALVES.




### CHEAP GALVANIC APPARATUS.

Fig. 1. Fig. 2.







Holloway Press: D. A. Doudney.



Digitized by Google

## CONICAL VALVES OF STEAM ENGINE.

Previous to the time of Watt, as we have already stated in former papers on the steam-engine, steam was only employed to force up the piston of a cylinder; the downward motion was obtained by means of the pressure of the atmosphere; and one of the first and most important improvements on Newcomen and Crawley's atmospheric engine was the introduction of steam above the piston, in order to force it downwards after it had been raised by the admission of steam below. One kind of apparatus by which the steam was admitted we have already described in our 18th Number, and our engraving this week represents the conical valves, used for the same purpose. They were situated in two small chambers placed on one side at the top and bottom of the cylinder. Our engraving only represents one of these steam chambers, from which the pipe K may be supposed to lead to the upper part of the cylinder and above the piston. The steam is supplied from the boiler through the apertures at the top of the diagram; that at the bottom leads to the condenser; when therefore the valves are in the situation represented a communication is open between the boiler and the top of the cylinder, the steam will consequently press on the piston and drive it downwards, and in doing this, by means of a piece of apparatus which connects the rod M with the working beam of the engine, the rod will be depressed, and consequently close the valve G.—At the same time the rod L, which passes through the hollow part of M, and to which the valve A is attached, is raised and the valve opened; there is then a communication between the top of the cylinder and the condenser, and when, therefore, steam having been admitted to the bottom of the cylinder, the piston rod is driven upwards, the steam above it escapes through K and H into the condensing vessel.

A variety of very ingenious pieces of mechanism have been employed at different times in place of the valves we have been describing, and not being so likely to get out of order, have been more generally employed. Indeed since the time of Watt, nearly every part of the machinery of the steam-engine has been improved, either in structure or workmanship, and it was not therefore likely that a part so important as the valves which regulate the supply of steam, should have been untouched. Those described above are ingenious, and if the reader understands the principle on which they act, he will easily comprehend those of other kinds that may have been employed for a similar purpose.

## CHEAP GALVANIC APPARATUS.

Obtain a number (say thirty) of the smooth old penny pieces; and the same quantity of plates of zinc of the same size. The pieces of zinc may be easily cast in a mould made of clay, for that metal is of about the same degree of fusibility as lead. In addition to the plates of copper and zinc, it is necessary to be provided with the same number of pieces of woollen cloth, rather smaller than those plates in size. Let them be soaked in a solution of common salt, till they have thoroughly imbibed it; when they are to be used they must be taken out of the solution and gently squeezed, in order to force out the superabundant water. The Voltaic Pile (A fig. 1.) is to be formed of these materials in the following manner: lay down on a piece of wood a plate of zinc, upon that a plate of copper, and then a piece of moistened cloth, let this arrangement be continued—zinc, copper, cloth—zinc, copper, cloth—till the piles that have been provided are laid on. As the pile began with zinc, it must be concluded with copper. The number of pieces of each substance must be at least twenty, and may be advantageously extended to fifty. But a pile thus formed, is when tall, very liable to be overthrown, and must therefore be supported. The method usually adopted to hold it up steadily, is to fix into the piece of wood on which the pile is formed three rods of glass, which may touch the pieces of metal at three equidistant points. Down these rods may slide a piece of wood, for the purpose of keeping by its pressure the different parts of the pile in close contact. Fig. 2. is intended to represent this top—the circle in the centre shows the situation of the pile, the three small circles between the outer and inner large circle show the places where holes are cut for the reception of the glass rods; the upper side of the piece of wood *b*, and the under side of the other piece of wood, must be lined with tin foil. In the figure is represented the arrangement employed in decomposing water, *c* is a glass tube filled with water, and having the ends closed with corks; *d* and *e* are wires, one of them having an end fixed to the top of the pile, and the other an end fixed to the bottom of it. The other ends of these wires are passed through the corks, and in the tube *c*, approach to within a quarter of an inch

Digitized by Google

of each other, (the pile for this experiment must be formed of at least fifty or sixty sets of plates). After some time the wire connected with the zinc, or positive end of the pile, will be oxidized at the end in the tube, while from the other (the negative) wire in the tube a stream of small bubbles of gas will arise. This gas is hydrogen, as may be proved by pulling out the cork, and instantly applying an ignited body to the tube, by which the gas will be inflamed. As the gas that is formed in the tube occupies more space than the water that is decomposed, it is necessary to make room in it by allowing some of the water to escape, this is done by cutting a small slit in the cork fastened in the bottom of the tube. If two wires of gold or platinum (which are not oxidable) be used instead of the copper wires, a stream of gas then issues from each, and collects at the top of the tube, forming a mixture of hydrogen and oxygen gas, which explodes on the approach of an ignited body. The gases may be obtained separately by passing each of the gold wires down a leg of a glass syphon, making them nearly meet at the bottom, and closing the opening at top by means of corks as before. The gas that will be formed will rise up the two legs of the syphon, the hydrogen up the leg containing the negative wire—the oxygen up the leg containing the positive wire—and it will be seen that the gases are formed from the decomposition of the water precisely in the proportions that are required to compose it, namely, two volumes of hydrogen to one of oxygen. In this case the water that must be suffered to escape to make room in the tube, must pass through a small hole ground in the bent part of the syphon, near where the two wires are opposite to each other.

The zinc plates in the voltaic pile become oxydated after being used a certain time, and then the galvanic action ceases; but they may be cleaned by being put into diluted muriatic acid, by which the oxide is dissolved. It is advisable when the voltaic apparatus is not to be used for some time to take it down, by which means the zinc plates will be prevented from wearing out too fast.

J. R. Watts, M. D.

## AEROSTATION.

NO. II.

The voyage of R. M. Pilatre and the marquis, may be said to conclude the history of those aerostatic machines which are elevated by means of fire, for though many other attempts have been made upon the same principle, most of them have either proved unsuccessful or of little or no consequence. They have, therefore, given place to those filled with hydrogen gas, or as it was termed, inflammable air, which by reason of its smaller specific gravity is both more manageable, and capable of performing voyages of greater length, as it does not require to be supplied with fuel like others. This was invented in a very short time after the discovery had been made by Montgolfier. This gentleman had indeed designated to keep his method secret from the world, but as it could not be concealed that a bag filled with any kind of fluid lighter than the common atmosphere, would rise in the atmosphere, inflammable air was naturally thought of as a proper succedaneum for the rarefied air of Montgolfier. The bag which contained the gas was composed of lute string, varnished over with a solution of the elastic gum called caoutchouc, or Indian-rubber; and that with which they made their first essay was about thirteen English feet in diameter. Many difficulties occurred in filling it, chiefly owing to their ignorance of the proper apparatus; for after a whole day, from nine in the morning, they filled it only about one-third. Next morning they were surprised to find that it had fully inflated itself during the night; upon inquiry, however, it was found that they had left open a stopcock connected with the balloon, by which the common air gaining access had mixed with the inflammable air; forming a compound still lighter than the common air, but not sufficiently light to answer the purpose required. They were obliged to renew their operation, and by six o'clock in the evening of the next day, the machine was much lighter than common air, and in an hour after it made considerable efforts to ascend; it was allowed to remain inflated for a whole day, during which it lost of equal ascent about three pounds, being one-seventh of the whole. When it was set at liberty, being well filled it was thirty-five pounds lighter than equal bulk of common air. It remained in the atmosphere three-quarters of an hour, during which time it traversed fifteen miles. It descended suddenly, which was supposed to have been owing to a rupture that took place before its ascent. After this Messrs. Rozier Arlandes tried a machine which was formed of gores of silk covered over with a varnish made of caoutchouc of a sperical figure, and measuring twenty-seven and-a-half feet in diameter. A net

Digitized by Google

was spread over the upper hemisphere, and was fastened to an hoop which passed round the middle of the balloon. To this a sort of car or boat was suspended by ropes so as to hang a few feet below the balloon, and in order to prevent the bursting of the machine a valve was placed in it, so that when opened some of the inflammable air might be let out. A long silken pipe communicated with the balloon by means of which it was filled. The boat or car was made of basket-work covered with painted linen, being eight feet long, four feet broad and three-and-a-half deep, it weighed 130 lbs. This time they also met with great difficulty in filling it. The weight of the whole apparatus, including the two adventurers, was 604½ lbs., and the power of ascent when they set out was twenty pounds. They continued in the air for one hour and three-quarters, when they alighted twenty-seven miles from Paris, having suffered no inconvenience during their voyage.

The subsequent aerial voyages differ so little from that just now related, that any particular description of them would be superfluous. It occurred, however, to Mr. Charles in his last flight, that there might be a possibility of directing the machine in the air, and this was attempted by M. Jean Pierre Blanchard, who had no doubt but that by adding wings to the balloon it would be in his power to direct it; but he found that all the strength he could apply was not sufficient to counteract the impression of the wind in any degree. He rose, it was thought, to very little less than 10,000 feet. In April 1784, Messrs. Morveau and Bertrand, at Dijon, prepared a kind of oar for directing the machine; by the working of two of them they were able to produce a sensible effect on the motion of the machine. Messrs. Charles and Robert repeated their former experiments with the addition of some machinery to direct their course. Having enlarged their former balloon to an oblong spheriod forty-six feet and three-quarters long, and twenty-seven and-a-half in diameter, they made it to float with its longest part parallel to the horizon. The wings were in the shape of an umbrella without the handle, to the top of which a stick was fastened parallel to the aperture of the umbrella, five of these were disposed round the boat, which was near seventeen feet in length. The balloon filled in three hours, and with the addition of 450 lbs. of ballast. During their voyage they lost an oar, but found that by means of those which remained they considerably accelerated their course. At one time they found themselves becalmed, so that they did not move two feet in a second. On this they tried the oars to the utmost, by working the thirty-five minutes and marking the shadow of the balloon on the ground they found that they had described the segment of an ellipsis whose longest diameter was 6000 feet. After they had travelled about 150 miles, they descended only on account of the approach of night, having still 200 lbs. of ballast left.

M. S.

## BIOGRAPHICAL SKETCHES.

### ALEXANDER WILSON.

THIS extraordinary man, who, from being originally an operative weaver, became, by his own unaided exertions, one of the most celebrated ornithologists of his day, was born in Paisley on the 6th of July 1766. His father was a distiller, poor in fortune, though said to have been endowed with an active and sagacious mind. He was so unfortunate as to lose his mother at the early age of ten, and was left without the tender and judicious care which a mother alone can give. On attaining his thirteenth year, he was bound apprentice for three years to his brother-in-law, to learn the business of a weaver, and on the expiry of this term continued to work as a journeyman for four years more.

The employment of a weaver was by no means congenial to the disposition and propensities of the future ornithologist; but as his father, though a highly respectable man in character, was in very indifferent circumstances, young Wilson had no choice left, but was compelled to adopt that which was readiest and most easily attained. It is much to his credit, however, that though he must have felt—indeed it is certain that he did feel, and that at a very early age—that he was fitted for higher things, he yet diligently laboured at the humble but honourable calling to which his destiny had appointed him, and never allowed such feelings to interrupt his industry. At this period of his life he indulged in a predilection for poetical composition, and wrote several pieces which appeared in the Glasgow Advertiser; but in these juvenile attempts he was not very successful, nor was he ever at any after period fortunate in this department of literature, though his poetical productions are certainly not without very considerable merit.

Having continued at the loom, as already said, for four years as a journeyman weaver, at the end of this period he aban-

Digitized by Google

deaned the business to accompany his brother-in-law, who had commenced travelling merchant or pedlar, in a tour through the eastern districts of Scotland—an employment which, though it could scarcely claim any sort of precedence in point of rank over that which he had left, he yet gladly embraced, as it at once released him from the confinement and dull monotony of his former occupation, and permitted him to indulge in one of his strongest propensities, which was to ramble over hill and dale, and to enjoy, unfettered and unrestrained, the beauties of his native land. With such a disposition it is not to be wondered at that as a pedlar he made much greater progress in the study of nature, and perhaps of man, and in the extending of his ideas, than in the improvement of his fortunes. The acquisition of money was no object with him, and of course, as it was not sought, it was not found.

Having embroiled himself in some serious disputes which took place in his native town between the operative weavers and their employers, by writing some severe personal satires on certain individuals of the latter class, he found his residence in Paisley no longer compatible with his comfort or happiness, and therefore determined on proceeding to America. But before taking his departure, he called on those persons whom he had satirised, expressed his sorrow for what he had done, and solicited their forgiveness. This circumstance is a pleasing proof of the generosity of his nature—that which follows a very striking one of the determination of his character. Although he had resolved on going to America, he did not possess a single shilling wherewith to pay his passage. To supply this desideratum, he instantly abandoned every other pursuit, and for four months laboured with incessant industry at his loom, confining the expense of his living during this time to one shilling in the week. The result of this perseverance and rigid economy was, that at the end of the period named, he found himself in possession of the requisite sum, but nothing more. With this he set out for Portpatrick on foot, crossed to Belfast, and there engaged a passage to America; and he arrived at New York on the 14th of July 1794, with only a few shillings in his pocket, and even these were borrowed from a fellow-passenger.

*(To be continued.)*

## IMPROVED CONDITION OF THE WORKING CLASSES.

Intellectual and social improvement go hand in hand. It therefore affords us sincere pleasure, when we can trace the gradual and certain improvement that has taken place in the social condition of those, whose "matchless industry" has contributed so materially to raise this country to the high station she now occupies. We have previously given some information on this subject, and we are happy to find so intelligent a man as *Junius Redivivus* confirming what we have stated. "Who, that looks at the present condition of the working classes," says he, "and has the means of knowing what their condition formerly was, can doubt for an instant their immense accumulation of comforts, which even the aristocrats of former ages scarcely knew by name? Look at the residence of a skilful mechanic, where the wretched deal table has given place to one of mahogany; where the rush-bottomed chair of rough wood is displaced by the cane and the horsehair—intrinsically better than those of a palace a century ago. Look at the comfortable bed, with its appurtenances of linen sheets, soft blankets, and pillows, and compare it with the straw and horsecloths which were formerly considered good lodgings; and the thousand and one other conveniences, tending to cleanliness and comfort, which even our wealthy ancestors never dreamed of. And the clothing of the mechanic! Thirty years back he was accustomed to buy a second-hand coat, or one of coarse wool, and that once in three or four years. His shirt was of the coarsest hemp cloth, his breeches of corduroy, his stockings of worsted, his heavy shoes greased, and his hat of the coarsest felt. And all these things carefully put by for Sunday's wear; his ordinary working clothes being most filthy, and more like the garb of a slave of low caste, than that of a freeman. But what is the fact now? Look at a decent mechanic, even in his ordinary garb, out of his workshop, and he presents a more respectable appearance than his master of the last generation. And in his Sunday garb, of which he now has, at any rate, one, and sometimes two, suits in the year—is there any thing in its material, or in his general external appearance, to distinguish him from the Corinthian capitals of society, save perhaps the hardness of his palms, or the peculiar gait impressed upon him by the nature of his business, the carpenterial stoop, or the sartorial bowing of the legs, in contradistinction to

Digitized by Google

# LIST OF ILLUSTRATIONS.


1. Frontispiece.
2. The Advertiser.
3. High Pressure Engine.
4. The Greenwich Railway.
5. De Caus Steam Engine.
6. The Air Gun.
7. Section of same.
8. Apparatus for rescuing Drowning Persons.
9. Diagram of same.
10. The Marquis of Worcester's Steam Engine.
11. Bell Rock Light House.
12. Section of same.
13. Diagram to find the Height of Objects.
14. Douglas's Steam Boiler.
15. Section of same.
16. The Safety Davy Lamp.
17. Opening of the Greenwich Railway.
18. King's Steam Boiler.
19. Diagram of same.
20. Gregory's detached Escapement for Watches.
21. Savery's Steam Engine.
22. Diagram of Railway Inclined Plane.
23. Another Diagram of same.
24. Woolf's Steam Boiler.
25. Woolf's Furnace.
26. Ancient Watch Tower at Dover.
27. Wood's Atlas Printing Press.
28. Lever of First Order.
29. Lever of Second Order.
30. Lever of Third Order.
31. Mode of filling Steam Boilers.
32. Patterson's Carriage Lock.
33. Gas Cooking Apparatus.
34. Diagram of Patterson's Carriage Lock.
35. Diagram of Levelling Railways.
36. The same.
37. Section of Savery's Steam Engine.
38. Branca's Steam Apparatus.
39. Puttich's Improved Boiler.
40. Spring and Barrel of a Watch.
41. Scapement of same.
42. Another form of Scapement.
43. Second and Minute Wheels of a Watch.
44. Minute and Hour ditto.
45. Double Acting Engine Valves.
46. Mechanism of a Watch complete.
47. The Governor of a Steam Engine.
48. A Perpetual Motion.
49. King's Force Pump.
50. King's Improved Steam Boiler.
51. Clement's Improved Window Sashes; Five Drawings.
52. Wheel and Axle.
53. Diagrams to illustrate same.
54. The Atmospheric Steam Engine.
55. Monday's Sofa Bedstead.
56. Illustration of a Railway.
57. Two Diagrams of Moveable Rails.
58. Turning Plate.
59. Section of same.
60. Steam Carriage Wheels
61. Two Sections of Rails.
62. Islington Cattle Market.
63. Ground Plan of same.
64. Robert's Hood and Mouth Piece.
65. The Patent Peripurist.
66. Section of same.
67. Gregory's Improved Balloon.
68. Valve for same.
69. Pocock's Patent Kites.
70. The Charvolant.
71. Gregory's Rotary Pump.
72. Rivet for Spring of ditto.
73. Morton's Improved Window Sash.
74. Three Diagrams for constructing Arches.
75. Cheap Electrical Apparatus.
76. A Simple Alarum.
77. Steam Boiler Explosion at Hull.
78. Eight Illustrations of Cowell's Patent Sash Suspenders.
79. Method of Boring Cannon.
80. Machine to rescue Drowning Persons.
81. An Improved Safety Lamp.
82. An Improved Pin Drill.
83. Cheap Electrical Apparatus—a Cylinder.
84. Rubber for ditto.
85. Apparatus to fix same.
86. Stand for same.
87. Cheap Electrical Machine complete.
88. A Perpetual Motion.
89. An Improved Alarum when set.
90. The same when gone off.
91. Section of a Steam Boiler.
92. Diagram of same.
93. Apparatus to rescue Drowning Persons.
94. Davenport's Electro-magnetic Engine.
95. Diagram of same complete.
96. An Improved Coach Drag.
97. The Vauxhall Balloon.
98. Mr. Cocking's Parachute.


Digitized by Google

Digitized by Google

JAMES WATT ESQR.

F. R. S. &c. &c.

LONDON.

Published by G. Berger for the Penny Mechanic & Chemist.

1831.

Digitized by Google

THE

# PENNY MECHANIC;

## A MAGAZINE

OF THE

## ARTS AND SCIENCES.

VOL. II.—1833-3.

**WITH NUMEROUS ILLUSTRATIONS.**

LONDON:

PUBLISHED BY D. A. DOUDNEY,

AT THE HOLLOWAY PRESS;

BERGER, HOLYWELL-STREET, STRAND;

AND MAY BE HAD OF ALL BOOKSELLERS.

Digitized by Google

HOLLOWAY PRESS:
D. A. DOUDNEY.

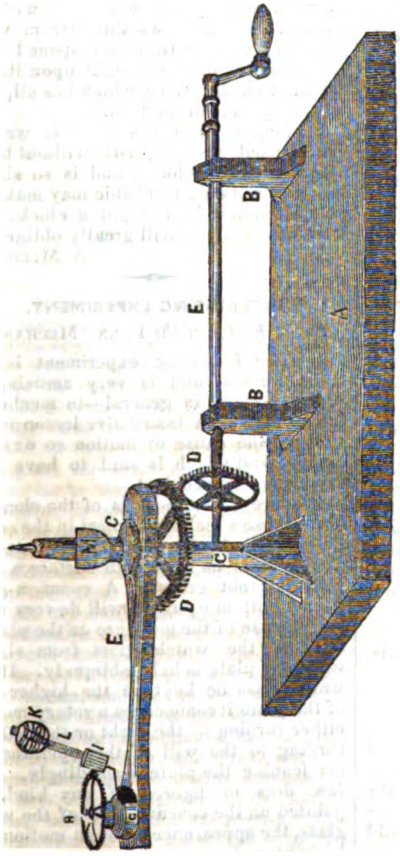
Digitized by Google

# THE PENNY MECHANIC,

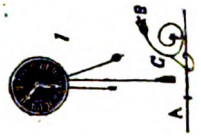
## AND THE CHEMIST.

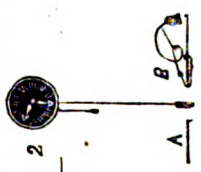
No. XLI.] SATURDAY, AUGUST 5, 1837. Vol. II.

CHEAP ASTRONOMICAL APPARATUS.—Fig. 1.




ALARUM.




CURIOUS EXPERIMENT.

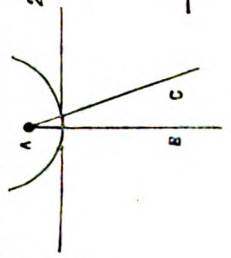
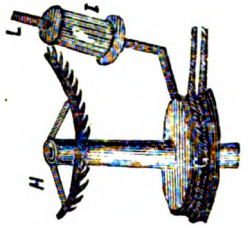



Fig. 2.






Holloway Press: D. A. Doudney.

Digitized by Google

## CHEAP ASTRONOMICAL APPARATUS.

*To the Editor of the Penny Mechanic.*

SIR,—I beg leave to offer to your readers the description of a machine which illustrates the motion of the earth round the sun, and on its own axis, together with the inclination of its axis to the plane of its orbit, the vicissitudes of day and night, and of the seasons. Fig. 1 shows the whole machine; and fig. 2 is the enlargement of one part of it, to illustrate its construction more clearly.

On the frame A fix three uprights C, B, B, as in fig. 1, and let the perpendicular wheel D (with a long spindle E to turn in sockets in B B) play into the corresponding horizontal wheel D, having the arm F fixed on it, so as to turn with it. On the part of the upright C which projects beyond the arm F, fix the pulley G, and a corresponding pulley G on the other extremity of the arm: this last pulley is to move on its axis, which must terminate in the stationary wheel H. Let the spindle L fall on the pulley G at an angle of 45 degrees, having a pinion I playing into the teeth of the wheel H: the pinion I must have an arm to fit into a small globe K (revolving on the top of the spindle L as in figure), which represents the earth. A socket M may be placed above the other pulley to receive a candle which represents the sun. The working of the machine will now be obvious.

The wheels D D being turned by a winch as in figure, the arm F is turned with them; and the effect of the pulleys will be always to preserve the earth's parallelism, while the pinion I playing against the circular rack-work H, will turn the earth on its axis a sufficient number of times to show the motion.

The whole can be made at a slight expense.

I remain, &c.,
RUGBŒENSIS.

## AN ALARUM.

*To the Editor of the Penny Mechanic.*

SIR,—Reading Number 37 of your useful little work, I perceive a description of an alarum as being more simple than the one formerly described. I admire the simplicity of it certainly; but I should like (if permitted) to point out an alteration, which, I have no doubt, you will think an improvement. Instead of the bell being hung up high, and the cord passing over the clock, as Mr. Gredley's simple alarum is described; which, by the jerk of the cord, is liable to shake the clock, and throw it out of beat; or the string might catch the pendulum and stop it outright. If any of your numerous readers should be induced to make one of these alarums, I should advise them to make it as I shall describe.

Fig. 1 represents the alarum set: A is a piece of board with trap-door in it, B is a common house-bell mounted on the board, C is a string attached to the bell with a knot (which is more simple than a wedge) far enough from the bell to reach the trap door when set, with another knot at the end secured to the board, the string left long enough to allow the bell to ring, and not get entangled with the weight. Fig. 2 shows the alarum when gone off: A is the trap-door opened with the pressure of the weight upon it, B is the knot on the string which has slipt off by the opening of the trap.

It being made in this portable way, it can be used when requisite without being attached to the clock; and is so simple that any working mechanic may make his own alarum, if he has got a clock. By inserting this you will greatly oblige,

A MECHANIC.

## INTERESTING EXPERIMENT.

*To the Editor of the* PENNY MECHANIC.

SIR,—The following experiment is not much known, and is very amusing to young persons in general—to mechanics it may afford an instructive lesson in examining the cause of motion so extraordinary, and which is said to have been discovered by accident.

Procure a watch-glass of the cheapest kind, those which are highest in the centre will answer best. Place the convex side of the glass on a smooth surface a little wet, but not greasy. A common plate turned bottom upwards will do very well, and the use of the moisture on the plate is to keep the watch glass from sliding when the plate is held obliquely. If the watch-glass be kept on the higher part of the plate it commences a rotary motion, either turning to the right or the left, according to the will of the operator, by his leaning the plate accordingly. If a few dots or figures of any kind, are painted on the concave side of the watch glass, the appearance while in motion will be improved.

The cause of motion in this experiment I take to be as follows. In the diagram, let A be the centre of gravity of the watch-glass, and A B the line of direction, as it will be when the plate is held in a horizontal position; but if the plate be inclined so that A C, becomes the line of

Digitized by Google

direction, then the centre of gravity not being supported, the watch-glass will have a tendency to roll, or shift the point of contact with the plate, towards the line A C, leaving the largest half of the watch-glass in the direction of the highest part of the plate. And as the glass cannot slide down the plate, it commences a rotary motion which will carry it to the lowest part, but may be kept in motion as long as the operator pleases, by changing the position of the plate so as to keep the glass upon the higher part of it.

PHILO.

## ACCIDENTS IN MINES.

THE following Petition of Mr. John Cooper Douglas which was presented by Mr. Pease, M. P., to the House of Commons, has been forwarded to us, and from it we extract the following passages. The Petitioner after referring to the Select Committee appointed to enquire into the subject, states, that it was adduced in evidence before the said Committee, in which the witnesses agreed, that the dangerous part of the working of a colliery generally commences with working or taking away the pillars, and that the mine is then placed under circumstances beyond control, so far as ventilation goes, inasmuch as the workings where the pillars have been removed, cannot be ventilated; and that it does not signify what force of ventilation may be had, if it cannot be applied to dislodge the gas; and that until some effectual plan can be devised for dislodging and expelling the gas entirely and effectually from those lodgements in vacant spaces occasioned by working the pillars, the chief cause of all the accidents will remain unabated.

That the Petitioner after having for a considerable period bestowed much of his time and attention to the consideration of the causes of explosions and accidents in coal mines, and the means of avoiding them, has discovered an effectual plan, as well for the collection of the gas generated in coal mines, and the application thereof to numerous useful purposes, as for ventilating, lighting, and working mines, and improving the machinery employed therein; by which the evils complained of will, in the opinion of your Petitioner, be entirely removed, and the destruction of life and property now frequently occurring, be wholly prevented. And your Petitioner has accordingly obtained His Majesty's Royal Letters Patent, for his said discoveries.

That the introduction of your Petitioner's improvements into coal mines will not only effectually remove the obstructions which at present arise in the working of mines from the accumulation of gas in consequence of their imperfect ventilation, but also, by allowing such portions of the pillars as are now usually left to be worked or taken off, will enable the entire quantity, or one hundred per cent. of coal to be wrought in every mine instead of forty-eight, or at most sixty-three per cent., which, according to the evidence taken before the said Committee of your honourable House, is the quantity of coal obtained under the present system; thus ensuring perfect safety to the miners, and at the same time causing a saving or gain to the coal proprietors of from thirty-seven to fifty-two per cent. in their coal.

That, in addition to the grand desideratum above described, your Petitioner sincerely believes that the following advantages will also result from his discoveries, should the same be carried into effect, viz.,

First. By the application of an apparatus described in the specification to your Petitioner's patent, a power will be obtained in the process of ventilating coal mines, capable of pumping up the water and gas which collect therein, and of raising the coals, and doing other things requiring great mechanical power.

Secondly. Another and effective power may be obtained under the same patent, by collecting the pure hydrogen gas from the blowers, and combining it with certain portions of oxygen gas, which being ignited in a close vessel, are converted into water, whereby a vacuum is produced, and a power obtained equal to a condensing steam engine.

Thirdly. By means of a lamp adapted for burning in coal mines, the gas, which has hitherto been the cause of so much loss of life and property, may be applied to the purpose of safely and more economically lighting the mines; thus for the most part rendering it unnecessary for the miners to carry about with them naked lights or lamps of any kind.

Fourthly. By means of an apparatus described in your Petitioner's specification, the gas generated in coal mines may be collected and usefully employed in the adjacent cities and towns, and may also be compressed to such a degree, as to make it portable at a very trifling expense, thereby rendering it applicable, in place of coal, to many useful and valuable purposes.

Fifthly. Your Petitioner has also dis-

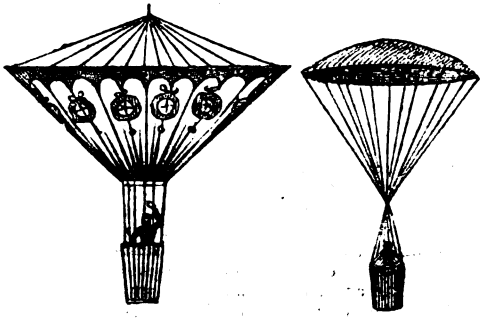
Digitized by Google

covered an improved safety lamp, described in your Petitioner's specification, which, from its construction, is not liable to become red hot even in a stream of gas; nor will it ignite the external atmosphere, although carried into a rapid current of air.

That, considering that the collecting of the gas generated in the coal mines of Great Britain and Ireland, which is now wholly lost, and the application of it to useful purposes as proposed by your Petitioner, would, if carried fully into effect, produce annually a large source of wealth and industry to the State, and that it is expedient, on the grounds of humanity, that your Petitioner's invention should be introduced into all mines, under some legislative regulation, your Petitioner is willing to place his said patent at the disposal of Parliament for the benefit of the nation, for such reasonable remuneration, as he may be considered fairly entitled to.

JOHN C. DOUGLAS.

COCKING'S PARACHUTE. GARNERIN'S PARACHUTE.



## DESCENT OF GARNERIN'S PARACHUTE IN 1802.

IN this age of ballooning, and at a time when the fatal experiment of Mr. Cocking forms a subject of general conversation, we think the following account with which we have been favoured of M. Garnerin's descent in a parachute in 1802, as given in his own words, cannot fail to be acceptable.

The parachute used by Garnerin on the occasion of his ascension in London, on the 21st of September 1802, was of cotton, and expanded in the manner of an umbrella. At the top of it ran round a hoop eight feet in diameter. In this part also was a circular aperture, where the cylinder terminated the cord by which the parachute was to be fastened to the balloon. The sides of the parachute, when it was expanded, were about fifteen feet long, and formed a sort of curtain. Garnerin placed himself, with a flag in his hand, in the basket suspended from the parachute. The cords by which this basket was fastened to the cotton stuff were tied just above his head in a knot, and from this knot ran cords to the extremities of the cotton. The cords and basket were about twenty feet long, reckoning from the end of the stuff. This parachute, which was attached to the balloon, hung at a considerable distance beneath it. As the balloon rose, the parachute followed, and it was impossible to view the aeronaut dangling in it at such a prodigious height without shuddering. At length Garnerin cut the cord by which the parachute was fastened to the balloon. At this sight many of the spectators were filled with the greatest alarm, fearing lest they should see him fall every moment. The balloon rose with extraordinary velocity, and the parachute descended with equal rapidity for half a minute, and then sunk slowly to the earth. As there was not sufficient ballast in the parachute, Garnerin swung backward and forward like the pendulum of a clock, but with much greater violence; at length he alighted in safety.

The following is Garnerin's account:—

The experiment of my 31st ascent, and of my fifth descent in a parachute, took place on a very fine day, and in the presence of an immense crowd of spec-

Digitized by Google

tators, who filled the streets, windows, houses, and the scaffoldings erected round the place of my departure, which, alas! was the only spot not crowded with spectators." [The price of admission to St. George's-parade, North Audley-street (the place from whence M. Garnerin ascended) was 5s., but the money taken did not amount to 180*l*., so that M. Garnerin must have lost considerably by his adventure. The cause is easily accounted for: curiosity is much better gratified by being at a distance from the ascent of a balloon. Persons of the first distinction, however had assembled on the ground, particularly the Earls Camden and Stanhope, Sir Francis Burdett, Mr. and Mrs. Sheridan. &c.]

"It is necessary, when I undertake the experiment of the parachute, that I should know the state of the atmosphere, in order to enable me to judge of the course I am to take, and also to adopt the proper precautions to insure success. About three o'clock in the afternoon I had the satisfaction of having a first indication from the agreeable effect of a very pretty Montgolfier balloon, which was set off from the environs of St. George's-parade, and which took a direction over Marylebone-fields.

"The success of this experiment ought not to prevent me from expressing my opinion of the danger that may result to the general safety from the daily abuse of those night experiments which are not always directed by persons conversant with the subject. One shudders to think that a machine of this kind may fall, and fall on fire, upon the cordage of a ship, and thus involve in a great conflagration all that constitutes the wealth of one of the first cities of the world. The use of these machines was prohibited in France, and the Consular Government confided to me alone the direction of night balloons, which I conceived and introduced into the national fêtes.

"Convinced of the direction of the winds, I hastened the filling of the balloon, and at 5 p.m. I filled the pilot balloon, which Mrs. Sheridan did me the honour to launch. It seemed to me that I was conciliating the favour of Heaven by the interference of the Graces. This pilot balloon ascended quickly, and was soon out of sight, marking my career towards the north-east. While the anxious crowd were following the path of my little pilot, I suspended the parachute to the balloon; this painful and difficult operation was executed with all possible address, by the assistance of the most distinguished personages. The parachute was gradually suspended, and the breeze, which was very gentle, did not produce the least obstacle. At length I hastened to ballast my cylindrical bark, and to place myself in it—a sight which the public contemplated with deep interest; it seemed, at the moment, as if every heart beat with unison: for, though I have not the advantage of speaking English, every one understood my signs. I ascertained the height of the barometer, which was at 29½ inches. I now pressed the moment of my departure, and the period of my fulfilling my engagements with the British public. All the cords were cut; I rose amidst the most expressive silence, and, launching into infinite space, discovered from on high the countless multitude that sent up their sighs and prayers for my safety. My parachute, in the form of a dome over my head, had a majestic effect. I quickened my ascending impulse, and rose through light and thin vapours, when the cold informed me that I was entering into the upper region. I perceived I had reached the extremity of the city, and that immense fields and meadows offered themselves for my descent; I examined my barometer, which I found had fallen 4·3 inches; the sky was clear, the moment favourable, and I threw down my flag, to endeavour to show to the people assembled that I was on the point of cutting the cord that suspended me between heaven and earth.

I made every necessary disposition, prepared my ballast, and measured with my eye the vast space that separated me from the rest of the human race. I felt my courage confirmed by the certainty of my combinations being just. I then took out my knife, and with a hand firm, from a conscience void of reproach, and which had never been lifted against any one but in the field of victory, I cut the cord. My balloon rose, and I felt myself precipitated with a velocity which was checked by the sudden expansion of my parachute. I saw that all my calculations were just, and my mind remained calm and serene. I endeavoured to moderate my gravitation, and the oscillation which I experienced increased in proportion as I approached the breeze that blows in the middle regions; nearly ten minutes had elapsed and I felt that the more time I took in descending, the safer I should reach the ground. At length I perceived thousands of persons, some on horseback, and others on foot, following me, all of whom encouraged me by their wishes, while they opened their arms to receive me. I came near the earth, and after one bound, I

Digitized by Google

landed, and quitted the parachute, without any shock or accident. The first person that came to me pressed me in his arms; but, without losing any time, I employed myself in detaching the principal circle of the parachute, anxious to save an instrument that so well guaranteed me; but a crowd soon surrounded me, laid hold of me, and carried me in triumph, till an indisposition, the consequence and effect of the oscillation I had experienced, obliged the procession to stop. I was then seized with a painful vomiting, which I usually experience for several hours after a descent in a parachute. The interval of a moment permitted me to get on horseback; a numerous cavalcade approached to keep off the crowd, whose enthusiasm and transports incommoded me not a little. The Duke of York was among the horsemen, and the procession proceeded with great difficulty in the midst of the crowd, who shouted forth their applause, and had before them the tri-coloured flag which I had thrown down, and which was carried by a member of Parliament. Among the prodigious concourse of persons on foot I remarked Lord Stanhope, from whom I received the counsels of a scientific man, and who penetrated through the crowd to shake hands with me. "GARNERIN."

According to M. Garnerin's calculation, he had been to the height of 4,154 French feet. The balloon fell on the next day, near Frindsham-mill, three miles beyond Farnham, in Surrey.

Much wonder was excited by the first ascension of a man in a balloon; but surely the descent of a man from an exalted balloon to the earth, without harm, is far more wonderful; it is, however, an experiment as daring as it is terrific.

---

Madame Garnerin, the daughter, we believe, of the celebrated Garnerin, has announced her intention to make a descent in a parachute, in the vicinity of the Parisian metropolis, in the course of the ensuing week.—*Times.*

---

## GALVANISM.

*Sketch of the Science of Galvanism:*—It was accidently discovered by Galvani an Italian, that if the crural nerve and the muscles of the leg of a recently-killed frog be laid bare, and we place a piece of zinc upon the nerve, and a piece of copper upon the muscle, and make the two metals, while so placed, touch each other, the leg of the frog is immediately thrown into violent convulsions. Volt, a friend of Galvani's, invented the pile and showed that shocks like those produced by electricity could be received from it. Shortly after it was found that water, and many other substances could be decomposed by the galvanic energy. It was next discovered that when compound bodies are decomposed, oxygen and acids accumulate round the positive pole, while hydrogen, alkalies, earths, and metals accumulate round the negative pole. Hence it was deduced that chemical affinity is identical with electrical attraction, and that the reason that oxygen combines with hydrogen, and acids with alkalies, earths, and metals, is that they are in opposite states of electricity. Galvanic electricity when properly excited and directed is sufficiently powerful to decompose any compound whatever, and even pure gold may be burned by being made to form a part of a galvanic circuit. We will now proceed to exhibit some of the effects produced by galvanic action. 1. Place a piece of metal zinc under the tongue, and a piece of copper (as a penny) upon the tongue, and bring the extremities of the metals into contact, the result will be the immediate perception of a curious taste, something resembling the taste of copperas. The metals have not this taste when not in contact; and, therefore, this experiment clearly shows the influence of excited galvanic electricity upon the organ of taste. 2. Moisten the under lip, lay upon it a shilling with the edges of it beneath the tongue, lay upon the tongue a piece of zinc, and bring the edges of the pieces of metal into contact—instantly the shilling will feel so intolerably hot that you will be obliged to let it fall from your mouth. You will then not hesitate to say—galvanic electricity has an influence over the sense of feeling. 3. Place a piece of zinc under the tongue, and put the small end of a silver tea-spoon in the mouth, between the teeth and the underlip, passing it up as high as possible, and pressing the extremity of it against the gums, then let the lower part of the spoon touch the edge of the piece of zinc—at the moment of contact a flash like lightning appears to the eye, which is renewed as often as you let the two metals touch each other. If you shut your eyes when you perform this experiment, you still see the light, and if you look sternly at a candle or other light, still you see it. Does not this afford ocular demonstration that galvanic electricity effects the organ of sight. 4. If a piece of silver and a piece of zinc have one extremity immersed in the same vessel containing sulphuric or muriatic

Digitized by Google

acid, largely diluted with water, the zinc is dissolved and yields hydrogen gas by decomposition of the water, the silver not being acted upon has no power of decomposing the water; but whenever the zinc and silver are made to touch, or any metallic communication is made between them, hydrogen gas is also formed at the surface of the silver. 5. Take a solution of sulphate of copper (blue vitriol) immerse a piece of silver in it, it will come out unchanged, immerse a piece of polished iron—it will receive a coat of copper, bring the iron and silver into contact and immerse them in the solution together—then both will be coated with copper.

J. R. Watts, M. D.

# THE CHEMIST.

## VINOUS FERMENTATION.

*To the Editor of the* Penny Mechanic.

*Lieux, Normandy.*

Sir,—I have before me an abstract of the proceedings of the French Academy of Sciences at their sittings of the 19th of June last. There is one communication on the subject of Vinious Fermentation which appears to me novel and curious. Perhaps it may be equally so to you or your readers, I will therefore translate the notice in question, to be inserted, or not, according to your opinion of its value.

"Monsieur Cogniard Latour announced that in the researches which he had undertaken on this subject, he had deviated from the mode of investigation ordinarily followed by chemists who had already occupied themselves with the subject of Vinious Fermentation, and that he had chiefly applied himself to study, with the aid of the miscroscope, the phenomena upon which this fermentation depends.

After having detailed in his paper, the various observations he had made by this means, he gave the following result of his researches:

1. That the yeast (*levure*) of beer is a mass of small globular bodies, *capable of reproducing themselves*, and, consequently, *organized*, and not an inert and purely chemical substance, as people have hitherto supposed.

2. These bodies appear to belong to the vegetable kingdom, and to reproduce themselves in two different ways.

3. They appear to act on a solution of sugar only as long as they are in a state of life, whence it is a probable conclusion that it is by some effect of their vegetation that they disengage the carbonic acid from the solution, and convert it into a spiritous liquor. "I would also remark," added M. Cognicard Latour, "that yeast considered as an organized material, merits the attention of physiologists in these particulars.

1. That it is produced and developed under certain circumstances, with great celerity, even in the midst of carbonic acid, as in the vats of Brewers.

2. That its mode of regeneration presents peculiarities of a kind which have never been observed with regard to other miscroscopic objects composed of isolated globules.

3. That it does not perish in severe cold, nor from the privation of water."

I regret, Mr. Editor, 'that I have not the means of furnishing you with some details of this curious discovery; but such as I have found, is at your service.

E. A.

*Marsei Metal, or Crystallised Tin.*—Clean a piece of tin from dirt or grease, by well washing it with warm soapy water, and rince it in clean water; then heat the tin to the temperature of bare sufferance to the hand, and pour on it, or apply with a brush or sponge, one of the following mixtures:—1, dissolve two ounces of common salt in four ounces of water, and add one ounce of nitric acid.—2, to two ounces of water add half an ounce of muriatic acid, and one fourth of an ounce of sulphuric acid.—3, either of the preceding in a greater or less degree of dilution. When the mixture has been applied, the tin is to be dipped into water slightly acidulated, and afterwards well washed in clean water. This process will cause the tin to assume an appearance of great beauty, and apparent crytsallization takes place, somewhat resembling mother-of-pearl, and curious figures, stars, and rude leaves appear. A transparent varnish, either coloured or colourless, may be laid on now which will give a fine polish to the work, and produce that brilliant covering so much employed for snuffer-stands, for covering pillars in shop-windows, &c. J. R. W.

*Imitations of Medals and Seals in Sulphur.*—Melt the sulphur and pour it into water. It then becomes soft and waxy, and can be made to take very exact impressions, from medals.

Digitized by Google

*Elopements by Steam.*—The Preston and Glasgow Railway passes through Gretna Green; and a journey to that place and back to London may be performed without inconvenience the same day. What perhaps is of greater importance to parties who adopt this plan of entering the holy state, they are sure not to be overtaken when once on the railway, as the trains cannot pass each other on the same line.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Aug. 9, T. Webster, esq., on Geology.—Friday, 11, John Hemming, esq., on Chemistry, at half-past eight o'clock.

*Aldersgate Street Literary and Scientific Institution.*—Wednesday, Aug. 9, J. S. Buckingham, esq., on Palestine, at eight o'clock.

*Eastern Athenæum.* — Wednesday, Aug. 9, G. Francis, esq., on Botany, at eight o'clock.

*Saint Pancras.*—Tuesday, Aug. 8, Dr. R. D. Thompson, on Food and Digestion, at half-past eight o'clock.

*Westminster Mechanics' Institution*, 5, Little Smith Street.—Thursday, Aug. 10, W. Maughan, esq., on the Steam Engine, at half-past eight o'clock.

*Bermondsey Mutual Instruction Society*, British School-room, Great George-street.—Monday, Aug. 7, Mr. T. Cousins, on Electricity, at half-past eight o'clock.

*Tower Street Mutual Instruction Society.*—Monday, Aug. 7, W. D. Saull, esq., on the Influence of Scientific Pursuits in Forming the Character of the Future Generations of Mankind, at half-past eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, Aug. 8, Col. Thompson, on Political Economy—the Currency, at half-past eight o'clock.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Prince Rupert's Drops.*—Sir, Can any of your correspondents inform me in what manner those little glass globules are made which burst with a sharp noise when they are scratched, or a portion broken off. They are, I think, called "Prince Rupert's Drops." Yours, obediently, G. L. T.

Sir,—Can any of your correspondents inform me how to harden wire that has been burnt. L. W.

*Colouring Glass.*—Sir, I should be very much obliged if any of your correspondents would inform me of the best method to prepare copper in the way it is used in general for colouring glass. W. S.

Sir,—I shall feel much obliged if you, or any of your correspondents can inform me how copper and iron articles are tinned. Yours, &c. A. Z

Sir,—I shall feel obliged to any of your correspondents who will inform me of the best method of suffling and preserving fish: also the best place for purchasing the eyes. Yours, &c., Walton.

Sir,—It will greatly oblige me if you, or any of your correspondents, will inform me of the best method of preparing the colour for, and painting candle-light scenery, and also the kind of canvass best adapted for the purpose.—The insertion of this will oblige your well-wisher and subscriber,

H. Wells.

### ANSWERS TO QUERIES.

*Gilding Picture Frames.*—The process for re-gilding picture-frames, that "Z." has given in No. 39, you will allow me to say, is incorrect: such a process might do for sculpture, but not for wood frames. So many layers of white paint, size, yellow ochre, Armenian bole, blood-stone, black-lead, and fat, &c. &c., would fill up all the cavities of the ornaments, and almost fill the grooves of the mouldings. To lay gold upon an oiled frame with water is wrong, the fat would work through and cause the gold to rub off; but to gild a frame in oil that has been gilt in water is easily done, as I shall show. "Z." advises shell gold to mend the defects; it would cost more for shell gold to mend the defects of a leaf-gilt frame than you might buy a perfect one outright for. I should advise your correspondent to give his frames to a gilder at once to be done, for the saving of expense would not pay him for his trouble. But perhaps it is amusement he wants, like many amateur mechanics; in that case I will give the best methods I can.

To regild in water gold, take a sponge and some clean water and wash the frame well; that done, let it dry: procure some water gold-size, from any artists' colourman; then make some thin size from dry hide or parchment; mix enough warm (not hot, it may cause it to crack) with the gold-size to enable you to work it on the frame with a camel-hair brush: give it two layers; when dry rub it over with a piece of fine sand-paper; it will then be ready for gilding. The gold should be turned out upon a cushion, and cut with a gilder's knife into agreeable shapes; but persons not accustomed to handling leaf gold might make a bungle of it, I would therefore advise him to lay it on thus: get a gilder's tip where you get your size (it will cost 3d.), wet with clean water the frame where you are going to lay your gold on, and with a camel pencil, first drawing the hairs of the tip across your face, to make the gold adhere enough to lift it to the frame, draw the gold into all the cavities. When the frame is covered, rest it on its edge to drain; when perfectly dry, dip your pencil into water, and press it between your lips, partly dry, and wipe the gold over with it; it will take the particles of gold off and make it appear solid. Any parts not being covered, take bits of leaf, with a dry pencil, and lay it on as before; that done give it a coat of clear parchment size; brush the back edges over with some ochre and size; the frame is then ready for use. A Mechanic.

## TO CORRESPONDENTS.

C. H. S. *Silver sand. It must be quite dry.*

F. C. P. *next week.*

S. J. Cooper's *paper will most probably be made serviceable.*

G. G. *Communications for the prizes of the Institute of Civil Engineers, noticed in our last Number, must be forwarded to the Institution, 1, Cannon Row, Westminster, on or before the 31st of March 1838.*

*The letter of* One of the unwashed—Operative Mechanic—*and Communications from several other Correspondents respecting a Mechanics' Institution shall receive an early attention.*

*We are much obliged to* C. Y. *for forwarding us the list of lectures.*

Working Men's Associations *next week.*

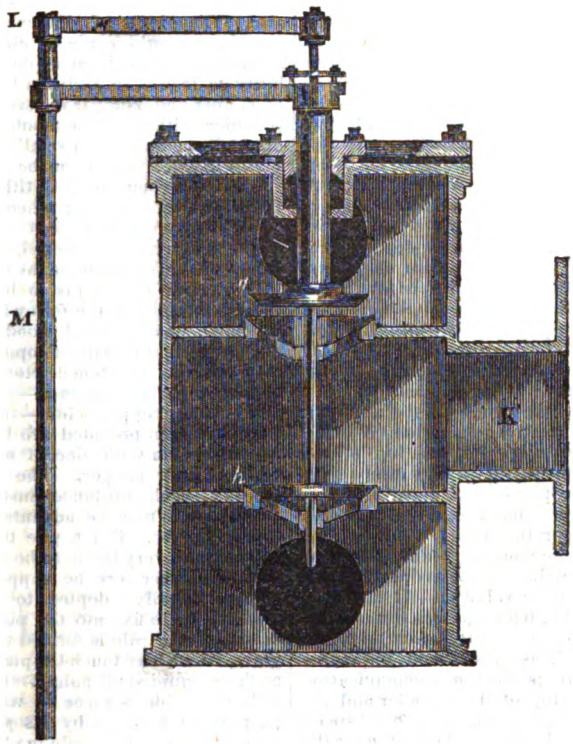
London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

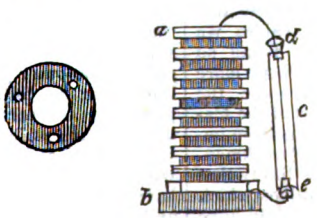
No. XLII.] SATURDAY, AUGUST 12, 1837. Vol. II.


### CONICAL VALVES.




### CHEAP GALVANIC APPARATUS.

Fig. 1. Fig. 2.





Vol. II.—No. XLII. Holloway Press: D. A. Doudney.



Digitized by Google

### CONICAL VALVES OF STEAM ENGINE.

Previous to the time of Watt, as we have already stated in former papers on the steam-engine, steam was only employed to force up the piston of a cylinder; the downward motion was obtained by means of the pressure of the atmosphere; and one of the first and most important improvements on Newcomen and Crawley's atmospheric engine was the introduction of steam above the piston, in order to force it downwards after it had been raised by the admission of steam below. One kind of apparatus by which the steam was admitted we have already described in our 18th Number, and our engraving this week represents the conical valves, used for the same purpose. They were situated in two small chambers placed on one side at the top and bottom of the cylinder. Our engraving only represents one of these steam chambers, from which the pipe K may be supposed to lead to the upper part of the cylinder and above the piston. The steam is supplied from the boiler through the apertures at the top of the diagram; that at the bottom leads to the condenser; when therefore the valves are in the situation represented a communication is open between the boiler and the top of the cylinder, the steam will consequently press on the piston and drive it downwards, and in doing this, by means of a piece of apparatus which connects the rod M with the working beam of the engine, the rod will be depressed, and consequently close the valve G.—At the same time the rod L, which passes through the hollow part of M, and to which the valve A is attached, is raised and the valve opened; there is then a communication between the top of the cylinder and the condenser, and when, therefore, steam having been admitted to the bottom of the cylinder, the piston rod is driven upwards, the steam above it escapes through K and H into the condensing vessel.

A variety of very ingenious pieces of mechanism have been employed at different times in place of the valves we have been describing, and not being so likely to get out of order, have been more generally employed. Indeed since the time of Watt, nearly every part of the machinery of the steam-engine has been improved, either in structure or workmanship, and it was not therefore likely that a part so important as the valves which regulate the supply of steam, should have been untouched. Those described above are ingenious, and if the reader understands the principle on which they act, he will easily comprehend those of other kinds that may have been employed for a similar purpose.

### CHEAP GALVANIC APPARATUS.

Obtain a number (say thirty) of the smooth old penny pieces; and the same quantity of plates of zinc of the same size. The pieces of zinc may be easily cast in a mould made of clay, for that metal is of about the same degree of fusibility as lead. In addition to the plates of copper and zinc, it is necessary to be provided with the same number of pieces of woollen cloth, rather smaller than those plates in size. Let them be soaked in a solution of common salt, till they have thoroughly imbibed it; when they are to be used they must be taken out of the solution and gently squeezed, in order to force out the superabundant water. The Voltaic Pile (A fig. 1.) is to be formed of these materials in the following manner: lay down on a piece of wood a plate of zinc, upon that a plate of copper, and then a piece of moistened cloth, let this arrangement be continued—zinc, copper, cloth—zinc, copper, cloth—till the piles that have been provided are laid on. As the pile began with zinc, it must be concluded with copper. The number of pieces of each substance must be at least twenty, and may be advantageously extended to fifty. But a pile thus formed, is when tall, very liable to be overthrown, and must therefore be supported. The method usually adopted to hold it up steadily, is to fix into the piece of wood on which the pile is formed three rods of glass, which may touch the pieces of metal at three equidistant points. Down these rods may slide a piece of wood, for the purpose of keeping by its pressure the different parts of the pile in close contact. Fig. 2. is intended to represent this top—the circle in the centre shows the situation of the pile, the three small circles between the outer and inner large circle show the places where holes are cut for the reception of the glass rods; the upper side of the piece of wood *b*, and the under side of the other piece of wood, must be lined with tin foil. In the figure is represented the arrangement employed in decomposing water, *c* is a glass tube filled with water, and having the ends closed with corks; *d* and *e* are wires, one of them having an end fixed to the top of the pile, and the other an end fixed to the bottom of it. The other ends of these wires are passed through the corks, and in the tube *c*, approach to within a quarter of an inch

Digitized by Google

of each other, (the pile for this experiment must be formed of at least fifty or sixty sets of plates). After some time the wire connected with the zinc, or positive end of the pile, will be oxidized at the end in the tube, while from the other (the negative) wire in the tube a stream of small bubbles of gas will arise. This gas is hydrogen, as may be proved by pulling out the cork, and instantly applying an ignited body to the tube, by which the gas will be inflamed. As the gas that is formed in the tube occupies more space than the water that is decomposed, it is necessary to make room in it by allowing some of the water to escape, this is done by cutting a small slit in the cork fastened in the bottom of the tube. If two wires of gold or platinam (which are not oxidable) be used instead of the copper wires, a stream of gas then issues from each, and collects at the top of the tube, forming a mixture of hydrogen and oxygen gas, which explodes on the approach of an ignited body. The gases may be obtained separately by passing each of the gold wires down a leg of a glass syphon, making them nearly meet at the bottom, and closing the opening at top by means of corks as before. The gas that will be formed will rise up the two legs of the syphon, the hydrogen up the leg containing the negative wire—the oxygen up the leg containing the positive wire—and it will be seen that the gases are formed from the decomposition of the water precisely in the proportions that are required to compose it, namely, two volumes of hydrogen to one of oxygen. In this case the water that must be suffered to escape to make room in the tube, must pass through a small hole ground in the bent part of the syphon, near where the two wires are opposite to each other.

The zinc plates in the voltaic pile become oxydated after being used a certain time, and then the galvanic action ceases; but they may be cleaned by being put into diluted muriatic acid, by which the oxide is dissolved. It is advisable when the voltaic apparatus is not to be used for some time to take it down, by which means the zinc plates will be prevented from wearing out too fast.

J. R. Watts, M. D.

## AEROSTATION.

NO. II.

The voyage of R. M. Pilatre and the marquis, may be said to conclude the history of those acrostatic machines which are elevated by means of fire, for though many other attempts have been made upon the same principle, most of them have either proved unsuccessful or of little or no consequence. They have, therefore, given place to those filled with hydrogen gas, or as it was termed, inflammable air, which by reason of its smaller specific gravity is both more manageable, and capable of performing voyages of greater length, as it does not require to be supplied with fuel like others. This was invented in a very short time after the discovery had been made by Montgolfier. This gentleman had indeed designated to keep his method secret from the world, but as it could not be concealed that a bag filled with any kind of fluid lighter than the common atmosphere, would rise in the atmosphere, inflammable air was naturally thought of as a proper succedaneum for the rarefied air of Montgolfier. The bag which contained the gas was composed of lute string, varnished over with a solution of the elastic gum called caoutchouc, or Indian-rubber; and that with which they made their first essay was about thirteen English feet in diameter. Many difficulties occurred in filling it, chiefly owing to their ignorance of the proper apparatus; for after a whole day, from nine in the morning, they filled it only about one-third. Next morning they were surprised to find that it had fully inflated itself during the night; upon inquiry, however, it was found that they had left open a stopcock connected with the balloon, by which the common air gaining access had mixed with the inflammable air; forming a compound still lighter than the common air, but not sufficiently light to answer the purpose required. They were obliged to renew their operation, and by six o'clock in the evening of the next day, the machine was much lighter than common air, and in an hour after it made considerable efforts to ascend; it was allowed to remain inflated for a whole day, during which it lost of equal ascent about three pounds, being one-seventh of the whole. When it was set at liberty, being well filled it was thirty-five pounds lighter than equal bulk of common air. It remained in the atmosphere three-quarters of an hour, during which time it traversed fifteen miles. It descended suddenly, which was supposed to have been owing to a rupture that took place before its ascent. After this Messrs. Rozier Arlandes tried a machine which was formed of gores of silk covered over with a varnish made of caoutchouc of a sperical figure, and measuring twenty-seven and-a-half feet in diameter. A net

Digitized by Google

was spread over the upper hemisphere, and was fastened to an hoop which passed round the middle of the balloon. To this a sort of car or boat was suspended by ropes so as to hang a few feet below the balloon, and in order to prevent the bursting of the machine a valve was placed in it, so that when opened some of the inflammable air might be let out. A long silken pipe communicated with the balloon by means of which it was filled. The boat or car was made of basket-work covered with painted linen, being eight feet long, four feet broad and three-and-a-half deep, it weighed 130 lbs. This time they also met with great difficulty in filling it. The weight of the whole apparatus, including the two adventurers, was 604½ lbs., and the power of ascent when they set out was twenty pounds. They continued in the air for one hour and three-quarters, when they alighted twenty-seven miles from Paris, having suffered no inconvenience during their voyage.

The subsequent aerial voyages differ so little from that just now related, that any particular description of them would be superfluous. It occurred, however, to Mr. Charles in his last flight, that there might be a possibility of directing the machine in the air, and this was attempted by M. Jean Pierre Blanchard, who had no doubt but that by adding wings to the balloon it would be in his power to direct it; but he found that all the strength he could apply was not sufficient to counteract the impression of the wind in any degree. He rose, it was thought, to very little less than 10,000 feet. In April 1784, Messrs. Morveau and Bertrand, at Dijon, prepared a kind of oar for directing the machine; by the working of two of them they were able to produce a sensible effect on the motion of the machine. Messrs. Charles and Robert repeated their former experiments with the addition of some machinery to direct their course. Having enlarged their former balloon to an oblong spheriod forty-six feet and three-quarters long, and twenty-seven and-a-half in diameter, they made it to float with its longest part parallel to the horizon. The wings were in the shape of an umbrella without the handle, to the top of which a stick was fastened parallel to the aperture of the umbrella, five of these were disposed round the boat, which was near seventeen feet in length. The balloon filled in three hours, and with the addition of 450 lbs. of ballast. During their voyage they lost an oar, but found that by means of those which remained they considerably accelerated their course. At one time they found themselves becalmed, so that they did not move two feet in a second. On this they tried the oars to the utmost, by working the thirty-five minutes and marking the shadow of the balloon on the ground they found that they had described the segment of an ellipsis whose longest diameter was 6000 feet. After they had travelled about 150 miles, they descended only on account of the approach of night, having still 200 lbs. of ballast left.

M. S.

## BIOGRAPHICAL SKETCHES.

### ALEXANDER WILSON.

THIS extraordinary man, who, from being originally an operative weaver, became, by his own unaided exertions, one of the most celebrated ornithologists of his day, was born in Paisley on the 6th of July 1766. His father was a distiller, poor in fortune, though said to have been endowed with an active and sagacious mind. He was so unfortunate as to lose his mother at the early age of ten, and was left without the tender and judicious care which a mother alone can give. On attaining his thirteenth year, he was bound apprentice for three years to his brother-in-law, to learn the business of a weaver, and on the expiry of this term continued to work as a journeyman for four years more.

The employment of a weaver was by no means congenial to the disposition and propensities of the future ornithologist; but as his father, though a highly respectable man in character, was in very indifferent circumstances, young Wilson had no choice left, but was compelled to adopt that which was readiest and most easily attained. It is much to his credit, however, that though he must have felt—indeed it is certain that he did feel, and that at a very early age—that he was fitted for higher things, he yet diligently laboured at the humble but honourable calling to which his destiny had appointed him, and never allowed such feelings to interrupt his industry. At this period of his life he indulged in a predilection for poetical composition, and wrote several pieces which appeared in the Glasgow Advertiser; but in these juvenile attempts he was not very successful, nor was he ever at any after period fortunate in this department of literature, though his poetical productions are certainly not without very considerable merit.

Having continued at the loom, as already said, for four years as a journeyman weaver, at the end of this period he aban-

Digitized by Google

doned the business to accompany his brother-in-law, who had commenced travelling merchant or pedlar, in a tour through the eastern districts of Scotland—an employment which, though it could scarcely claim any sort of precedence in point of rank over that which he had left, he yet gladly embraced, as it at once released him from the confinement and dull monotony of his former occupation, and permitted him to indulge in one of his strongest propensities, which was to ramble over hill and dale, and to enjoy, unfettered and unrestrained, the beauties of his native land. With such a disposition it is not to be wondered at that as a pedlar he made much greater progress in the study of nature, and perhaps of man, and in the extending of his ideas, than in the improvement of his fortunes. The acquisition of money was no object with him, and of course, as it was not sought, it was not found.

Having embroiled himself in some serious disputes which took place in his native town between the operative weavers and their employers, by writing some severe personal satires on certain individuals of the latter class, he found his residence in Paisley no longer compatible with his comfort or happiness, and therefore determined on proceeding to America. But before taking his departure, he called on those persons whom he had satirised, expressed his sorrow for what he had done, and solicited their forgiveness. This circumstance is a pleasing proof of the generosity of his nature—that which follows a very striking one of the determination of his character. Although he had resolved on going to America, he did not possess a single shilling wherewith to pay his passage. To supply this desideratum, he instantly abandoned every other pursuit, and for four months laboured with incessant industry at his loom, confining the expense of his living during this time to one shilling in the week. The result of this perseverance and rigid economy was, that at the end of the period named, he found himself in possession of the requisite sum, but nothing more. With this he set out for Portpatrick on foot, crossed to Belfast, and there engaged a passage to America; and he arrived at New York on the 14th of July 1794, with only a few shillings in his pocket, and even these were borrowed from a fellow-passenger.

*(To be continued.)*

## IMPROVED CONDITION OF THE WORKING CLASSES.

Intellectual and social improvement go hand in hand. It therefore affords us sincere pleasure, when we can trace the gradual and certain improvement that has taken place in the social condition of those, whose "matchless industry" has contributed so materially to raise this country to the high station she now occupies. We have previously given some information on this subject, and we are happy to find so intelligent a man as *Junius Redivivus* confirming what we have stated. "Who, that looks at the present condition of the working classes," says he, "and has the means of knowing what their condition formerly was, can doubt for an instant their immense accumulation of comforts, which even the aristocrats of former ages scarcely knew by name? Look at the residence of a skilful mechanic, where the wretched deal table has given place to one of mahogany; where the rush-bottomed chair of rough wood is displaced by the cane and the horsehair—intrinsically better than those of a palace a century ago. Look at the comfortable bed, with its appurtenances of linen sheets, soft blankets, and pillows, and compare it with the straw and horsecloths which were formerly considered good lodgings; and the thousand and one other conveniences, tending to cleanliness and comfort, which even our wealthy ancestors never dreamed of. And the clothing of the mechanic! Thirty years back he was accustomed to buy a second-hand coat, or one of coarse wool, and that once in three or four years. His shirt was of the coarsest hemp cloth, his breeches of corduroy, his stockings of worsted, his heavy shoes greased, and his hat of the coarsest felt. And all these things carefully put by for Sunday's wear; his ordinary working clothes being most filthy, and more like the garb of a slave of low caste, than that of a freeman. But what is the fact now? Look at a decent mechanic, even in his ordinary garb, out of his workshop, and he presents a more respectable appearance than his master of the last generation. And in his Sunday garb, of which he now has, at any rate, one, and sometimes two, suits in the year—is there any thing in its material, or in his general external appearance, to distinguish him from the Corinthian capitals of society, save perhaps the hardness of his palms, or the peculiar gait impressed upon him by the nature of his business, the carpenterial stoop, or the sartorial bowing of the legs, in contradistinction to

Digitized by Google

the erect arrogance of the race from whom officers of the army are made; and perhaps a look of greater shrewdness and more intellect than the scions of aristocracy display? And his food: how infinitely has it improved in its quality! In most trades, there is a custom of ancient standing, for the master of a manufactory to give his workmen an annual dinner, called a beanfeast; which it literally was, being held at the season when beans and bacon are in their prime. The custom is still kept up, and perhaps it would be "more honoured in the breach than in the observance," as it is an annual drunken-bout; but beans and bacon are no longer seen, having given place to more delicate viands instead of pipes and ale of the elder time. A journeyman mechanic would think himself ill used, who should be obliged to eat butcher's meat on such a day. In the same proportion as this, is the difference of their ordinary food. In this assertion I am borne out by Mr. Hogg, the Ettrick Shepherd, an authority of no mean weight; who, himself a farmer, states that the labourer's food of the present day has improved beyond all comparison, which is contrary to the generally received notion; but the fact is, that the most industrious propagators of notions are frequently not the most accurate examiners. Thus, with regard to the assertion that the fat ale of former days has given place to miserable porter, it is not founded on fact; for the class who now drink porter, drank water in the last generation, and the former ale-drinkers have now taken to wine; the class who walked on foot now keep horses, and the horse-keeping esquires of the country are now converted into the chariot-keeping esquires of the town. The banker no longer dwells over his counters in a close alley of the city, but keeps a handsome country house, and rolls to business in his carriage; while his clerk comes up from his country lodging by stage. Shallow-minded people call this extravagance, and living beyond means, and thereupon prophecy downfall, and allege that it is to such things that the number of bankruptcies, are owing. But this is absurd. It is only an evidence of the increased wealth of the whole community; and as for bankruptcies, it may be questioned whether they are more, in proportion to the quantity of business, than they ever were. Extravagance is merely comparative at all times, and must be considered only with regard to means. It would be very extravagant at present for a man to bathe every day in attar of roses as plentiful as water. A Canadian, sleeping in the woods, will consume several large pine trees for his watch-fire. A native of Potosi, on hearing of such a thing, might exclaim against it as a piece of wanton extravagance; because, in the town of Potosi, each tree would be worth a thousand dollars. What would Alfred the Great have said, could he have risen from his rush-strewn hall of rough-hewn timber, to enter the magnificent saloons of Paris or London at the present day? People in general, especially shallow people, are apt to be astonished at every thing that is richer than what they have been accustomed to, and immediately call it extravagance; whereas, it is only an evidence that there is much surplus labour in the community, and consequently that more can be spared for the arts of refinement."

## NEW PRINTING PRESS.

One of our most ingenious mechanics, Mr. Thomas Trench, has invented a new printing press, which will eclipse every thing of the kind heretofore put in operation. It is intended for stereotype plates, and will work off fifty reams of paper, of mammoth size, per day. It is intended to be attached to paper mills, and will print as fast as any mill can manufacture the paper. The register, by a simple regulation, can easily be changed, and made perfect. We have now a sheet in our office, worked on this new press, twenty-six feet long, printed on both sides at a time, in a quarter of a minute. The sheet contains two books of 160 pages each. The cost of a first-rate press, on this principle, will not exceed 1,000 dollars.—*New York Evening Post.*

*Tin.*—If tin be kept in fusion with access of air, its surface is speedily covered with a greyish pellicle, which is renewed as fast as it is removed. If this grey oxide be pulverized and sifted, to separate the uncalcined tin, and calcined again for several hours, under a muffle, it becomes the yellow oxide of tin, called among artizans *putty of tin*, and extensively used in polishing of glass, steel, and other hard bodies.

Nickel, united to tin, forms a white and brilliant mass. Half a part of tin, melted with two parts of cobalt, and the same quantity of muriate of soda, furnished Beaume with an allow in small close grains of a light violet colour. Equal parts of tin and bismuth form a brittle alloy, of a medium colour between the two metals, and the fracture of which presents cubical facets.

Digitized by Google

# THE CHEMIST.

## SIMPLE SUBSTANCES.

The Earth, and the various substances, animate and inanimate, that are found upon it, however diversified in their appearance, and different in their sensible qualities, are all formed out of a few simple elements, which, combining together in different proportions form the vast variety of animals, vegetables, and minerals, with which we are acquainted. The manner in which one of these elements, for example, combines with another, and by so doing produces compound bodies differing in every respect from the elements themselves, may be easily shown by one or two simple experiments. The atmosphere is a compound of

| | | |
|---|---|---|
| Nitrogen, . 4 | Oxygen, | 1 |
| Nitrous Oxide, or Laughing Gas | Nitrogen, 2 | Oxygen, 1 |
| Nitric Acid . . . . | 2 | Oxygen, 5 |

If the gases are mixed in these proportions, then we have three compounds entirely different in their qualities—the last being an active poison, while the first is necessary to our very existence; and this great difference in these gases is entirely occasioned by the slight difference in the proportion of the elements which combine to form them. In the combinations of carbon we have a striking example of the different forms one element of matter can assume. Every one knows the appearance of charcoal, and how different it is, in all respects, to the brilliant diamond; yet the labours of our most eminent chemists have all tended to show that the diamond is only charcoal in a peculiar state of crystallization. Although we cannot form diamonds from carbon, we can transform them into it, as they are combustible, and produce carbonic acid when burned in oxygen gas. Again, it is well known that sugar is a vegetable production, and that vegetables are composed almost entirely of oxygen, hydrogen, carbon, and azote or nitrogen. Sugar consists principally of the three former, and the hydrogen and oxygen are in the proportions necessary to form water. If therefore we take a piece of lump sugar and pour over it a small quantity of sulphuric acid (oil of vitriol), the acid, having a great affinity for water, will combine with it, and leave the carbon behind. The lump sugar will turn quite black, and will not differ much in appearance from a lump of charcoal.

Before entering more fully into the composition of bodies, we have thought it better to present our readers with a list of the elements at present known; to them we have attached their atomic numbers. We shall explain the atomic theory at length in a future Number for the benefit of those who are unacquainted with it; in the mean time the table will perhaps be useful to those who are:

| GASES. | NO. |
|---|---|
| Hydrogen..... | 1 |
| Oxygen ..... | 8 |
| Nitrogen ..... | 14 |
| Chlorine ..... | 36 |
| Sulphur ..... | 16 |
| Carbon ..... | 6 |
| Phosphorus .... | 16 |
| Boron ..... | 8 |
| Iodine .....124 | |
| Silicium ..... | 8 |
| Bromine ..... | 75 |
| Fluorine ..... | 18 |
| **METALS.** | |
| Gold .....200 | |
| Mercury .....200 | |
| Silver .....110 | |
| Lead .....104 | |
| Platinum ..... | 96 |
| Tin ..... | 58 |
| Iron ..... | 28 |
| Copper ..... | 32 |
| Zinc ..... | 34 |
| Selenium ..... | 40 |
| Lithium ..... | 10 |
| Aluminum .... | 10 |
| Magnesium .... | 12 |
| Glucinum .... | 18 |
| Calcium ..... | 20 |
| Sodium ..... | 24 |
| Cobalt ..... | 26 |
| Nickle ..... | 26 |
| Manganese .... | 28 |
| Chromium .... | 28 |
| Iridium..... | 30 |
| Titanium ..... | 32 |
| Tellurium..... | 32 |
| Ittrium..... | 34 |
| Arsenic..... | 38 |
| Zirconium .... | 40 |
| Potassium .... | 40 |
| Strontium..... | 44 |
| Antimony .... | 44 |
| Rhodium ..... | 44 |
| Molydenum .... | 48 |
| Cerium ..... | 50 |
| Cad mum ..... | 56 |
| Palladium .... | 56 |
| Thorimum .... | 68 |
| Barium ..... | 70 |
| Bismuth ..... | 72 |
| Jungsten ..... | 96 |
| Columbium ....144 | |
| Uranium .....208 | |
| Osmium .....100 | |
| Vanadium .... | 67 |
| Pluranium .... | |

---

*To the Editor of the Penny Mechanic.*

*Marking Inks.*—Sir,—A friend of mine, Mr. J. Francis, of Brighton, a few weeks ago, whilst experimenting on the nitrate of silver, discovered a very simple means of removing the stain of this salt; and consequently of all indellible chemical marking inks, of which this salt constitutes the base. All that requires to be done to remove the mark or stain of these inks from any article is, to immerse it in a little of the liq. Amon. Fort. of the chemist's shops. In about 10 minutes the colour will be much faded, and in 10 minutes more it will totally have disappeared; thus entirely destroyed the long-established fame of the never-failing indellible, chemical marking inks, which we see vended in every chemist's shop we enter, be it in town or country.

P. S. — Persons trying the above, must be sure and immerse the article in the liq. amon: or the experiment will not succeed.

B.

Digitized by Google

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Aug. 16, T. Webster, esq., on Geology.—Friday, 18, John Hemming, esq., on Chemistry, at half-past eight o'clock.

*Aldersgate Street Literary and Scientific Institution.*—Wednesday, Aug. 16, J. S. Buckingham, esq., on Palestine, at eight o'clock.

*Saint Pancras.*—Tuesday, Aug. 15, Dr. R. D. Thompson, on National Economy, at half-past eight o'clock.

*Westminster Mechanics' Institution*, 5, Little Smith Street.—Thursday. Aug. 17, A. Parsey, esq., on Perspective Rectified, at half-past eight o'clock.

*Bermondsey Mutual Instruction Society*, British School-room, Great George-street.—Monday, Aug. 14, Mr. T. Cousins, on Electricity, at half-past eight o'clock.

*Tower Street Mutual Instruction Society.*—Monday, Aug. 14, Mr. Toombes, on the Science of Phrenology, at half-past eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, Aug. 15, Mr Johnson on Oratory, at half-past eight o'clock.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Having seen my former Queries attended to, I take the liberty of asking "Firebrand," or some other of your readers a little information respecting Blue Lights; are they to ascend? and what is the reason of making the case of hard wood, and of a conical form?—Also I wish to know how the fine Blue and Red, or rather Carmine Stars are made, that are used for rockets, which we see of a Summer's evening in the different places of amusement?—If you will insert these queries in your valuable Magazine, you will much oblige

Your obedient Servant.

D. J.

*Air Pump.*—SIR,—Will you, or one of your correspondents, have the kindness to inform me through your valuable periodical, of a simple and cheap method of making an Air Pump; or where one can be purchased. Also, where the society newly formed in London, is held for the encouragement of the study of Electricity.

I am, Sir,

Your very humble Servant,

GEORGE.

SIR,—Can you, or any of your readers inform me what prizes, for Inventions and Improvements in Mechanics, Chemistry, and Manufactures, are given by the "Society of Arts" this year, or where a list of them may be seen?

[In Number 9 of PENNY MECHANIC.—A list may be obtained at the Society's Office in the Adelphi.—ED. P. M.]

SIR,—I should be much obliged to any of your correspondents who would inform me of the best method to make the composition for Letter-press Printers' Inking-balls.

I am Yours,

A SUBSCRIBER.

ANSWERS TO QUERIES.

*Prince Rupert's Drops.*—There is a philosophical toy, called by this name, (a pear-shaped lump of glass with a slender stalk), which illustrates the effect of suddenly cooling any substance when much heated. To make one of these drops, the glass, while in a state of fusion, is let fall into water, and is thereby suddenly cooled and solidified on the outside before the internal part is changed; then as the internal part at last hardens and would contract, it is kept unnaturally extended by the arch of external crust to which it coheres. If a portion of the neck of the lump be afterwards broken off, or if other violence be done, which jars its substance, the stained cohesion is destroyed, and the whole mass crumbles to dust with a kind of explosion. Any glass cooled suddenly when first made remains very brittle, for the reason now explained. What is called the *Bologna Jar* is a very thick small bottle, so prepared, which bursts when a grain of sand is let fall into it. The process of annealing, to render glass-ware more tough and durable, is merely the allowing it to cool very slowly by placing it in a hot oven, so that the whole may become solid nearly at the same time.

ARNOTT.

## TO CORRESPONDENTS.

*Correspondents are in future requested to direct their Letters* "To the Editor, AT THE PRINTER'S, Holloway Press, Islington." *All communications to be Post Paid.*

Jingle. *We shall probably be able to find room for the letter.*

W. R. *is thanked for writing, but we think the plan that has been proposed preferable.*

Edward Labern's *letter is unintelligible.*

E. Campbell. *The extract from Arnott will perhaps be made use of.*

Formator *wishes to know of a good work on Architectural Ornaments. Probably the* Encyclopædia of Ornaments, *now in course of publication, would suit him.*

Lewis H. *will find some works mentioned in Number 6.*

*We have received* M. Rough's *communication, and* Sir John Ross's *letter.*

*Received* Frank.—L. B.—Chemicus—*and* George.

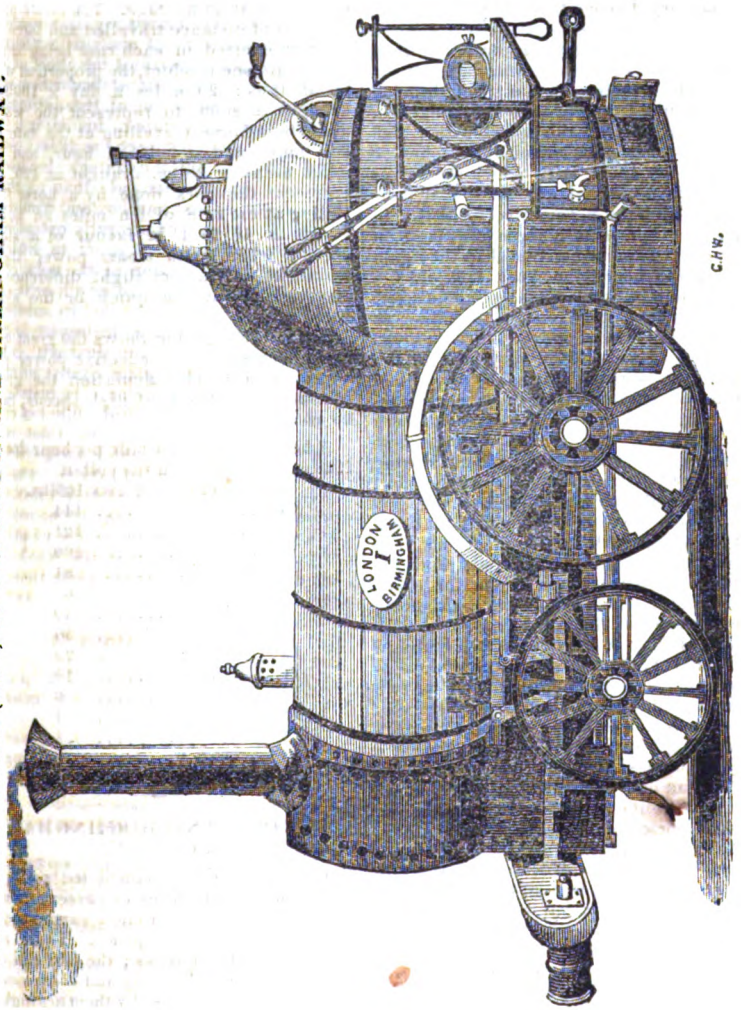
*Several Queries and Answers must stand over.*

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. XLIII.] SATURDAY, AUGUST 19, 1837. Vol. II.




FIRST CLASS ENGINE (No. 1) OF THE LONDON AND BIRMINGHAM RAILWAY.

*Made by Mr.* E. Bury, *of Liverpool.*

Vol. II.—No. XLIII. Holloway Press: D. A. Doudney.

Digitized by Google

## HORSE POWER.

THE following evidence of the advantage of steam power over that of horses, was given by Mr. John Farey, civil engineer, before a committee of the House of Commons, appointed in 1831, to enquire into the subject of steam carriages on common roads. The table showing the strength of horses is given by Gordon, in his work on Elementary Locomotion, and may be depended on. Horses have only a limited speed at which they can travel if they have no load to carry or drag after them, the whole of their muscular strength being then required to advance the weight of their own bodies; the speed with which stage coaches now travel approaches so near to the speed with which the horses could travel without any load, that their force of draught becomes very small. In all cases, horses lose force of draught in a much greater proportion than they gain speed, and hence the work they do becomes more expensive as they go quicker. The quickest stage coach travelling is now at the rate of eleven miles an hour, and that appears to be very near to the utmost limits which nature has prescribed for animal exertion; for those horses require renewal of the whole stock every two or three years. This is a comparison of steam power and horse labour, during the time that each is actually in operation; but the real difference between the performance of a steam engine and that of a set of horses will be found to be very great, when it is considered, that by having one spare steam coach for every two or three which are on the road, those coaches can travel continually all the year round, during fourteen or fifteen hours in every twenty-four hours, without any intermission, except stopping for one or two minutes to take in water at every stage of about seven or eight miles; and thus each steam coach can travel 140 or 150 miles a day; whereas a set of four stage coach horses can only work during seven hours and a half out of every twenty-four hours, or each horse can run fifteen miles a day, and that exertion wears them out very soon. A cart horse, travelling at the rate of two miles and a half an hour, can work during eight hours out of every twenty-four hours, or he can travel twenty miles in a day. Suppose that in both cases, of horses going ten miles an hour or only two miles and a half an hour, the force of traction was the same during the time that they were actually drawing; even on that supposition, there would be the difference between twenty miles a day and fifteen miles a day in favour of slow travelling; but in considering the work performed the great loss in the force of draught by quick travelling must be taken into account; and it will be found that a cart-horse, walking at two miles and a half an hour, could draw with a force of traction 100lbs. on an average, but that a stage-coach horse, running at ten miles an hour, cannot exert more than 28lbs. force of traction at an average. The above proportions of distance travelled and force of traction exerted in each case being combined into one product, the proportion will stand thus: 20 miles a day × 100lbs. draught = 2000, to represent the work done by a horse travelling at the rate of two miles and a half an hour, and 15 miles a-day × 28lbs. draught = 420, to represent the work done by a horse travelling at the rate of ten miles an hour, which is 4¾ to 1 in favour of a slow speed; when with steam power there would be only a very slight difference of performance, at the quick or the slow speed.

The following table shows the great and rapid decrease of the effective power of a horse; from which calculation the great advantage of steam, at high speeds, may be ascertained.

A horse travelling 1 mile per hour draws 196lbs. actual pull on the collar.

| | | |
|---|---|---|
| 2 | mile per hour draws | 169lbs. |
| 3 | ..... | 144 |
| 4 | ..... | 121 |
| 5 | ..... | 100 |
| 6 | ..... | 81 |
| 7 | ..... | 64 |
| 8 | ..... | 49 |
| 9 | ..... | 36 |
| 10 | ..... | 25 |
| 11 | ..... | 10 |
| 12 | ..... | 9 |
| 13 | ..... | 4 |
| 14 | ..... | 1 |
| 15 | ..... | nothing |

## LONDON AND BIRMINGHAM RAILWAY.

THIS Railway is now completed as far as Boxmoor, to which place passengers are conveyed by the third class carriages for two shillings and sixpence. There are three kinds of carriages; the first and second classes are elegantly and conveniently fitted up, but the fares by them are higher than the sum above mentioned. In order to have a good view of the country, however, we would advise those who intend to travel on the Railway, to go by the third class carriages, which are uncovered. This

Digitized by Google

will be a serious inconvenience to travellers in the winter, and we think the company will find it advisable to afford additional accommodation. The entrance to the Railway is at the back of Euston-square, New-road. A beautiful facade is being erected, which, when finished, will not have cost less than 30,000*l*. Although it will give the Railway a noble appearance from the metropolitan terminus, we question whether the Company will not find, that the Railway had better have been finished to its termination at Birmingham, before so large an expenditure of capital was incurred on an entrance only. After entering the gates, on the right hand side the visitor will find the offices where tickets for the carriages are to be obtained, and without which persons will not be admitted on the train. We experienced much inconvenience in obtaining our ticket, in consequence of the number of persons who were waiting for the same purpose, and the strange plan adopted by the Company of taking down the name of every passenger. We cannot conceive that any useful purpose is effected by this arrangement, as we saw several persons who got one gentleman to take tickets for them all in his own name. The plan of merely giving checks, as adopted by the Greenwich Railway, appears much preferable. Shortly after leaving the Euston-square terminus, the traveller has the opportunity of forming an opinion how far it is desirable to avoid tunnelling in the construction of railways, as the train then passes through a tunnel of considerable length, where it is quite dark, except here and there, where a small ray of light breaks through some minute opening above. We are sure, that if any plan can be adopted for lighting the tunnel, it will be much to the satisfaction of the public. It has been stated, that only one line of rails is laid in the tunnel, and consequently, in case two opposite trains should meet, a serious accident would be sure to ensue. But this statement is incorrect; there are two lines of rails in the tunnel, as along the whole Railway; and although it might not be pleasant for passengers to pass each other in the tunnel, there would be no more danger than if they did so at any other part of the Railway. The rails at various parts of the line are supported in different ways, in order, we presume, to determine by actual experiment which kind of support is the most durable and economical. The blocks of granite upon which the rails rest for a considerable portion of the line, are said to have cost a guinea a pair; on other parts wood is used for the same purpose, and is considered preferable. We did not take notice of the average speed of the trains, but we perceived that one of the officers of the Company, who travelled with the train, was provided with a chronometer, by which we presume that the time of performing the distance is limited. At different parts of the line, men are placed who give warning of the approach of opposite trains, and also clear the rails of any dirt or stones that may be thrown on them. The small particles of dust thrown up by the train during a portion of the journey, are very annoying.

We had hoped the Company would have fixed their prices so as to have brought the pleasure of an excursion within the reach of the humbler classes. Sixpence is the utmost amount that three-fourths of the population of the metropolis can afford; for a working man, taking his wife with him, at this rate must pay two shillings into the coffers of the firm.

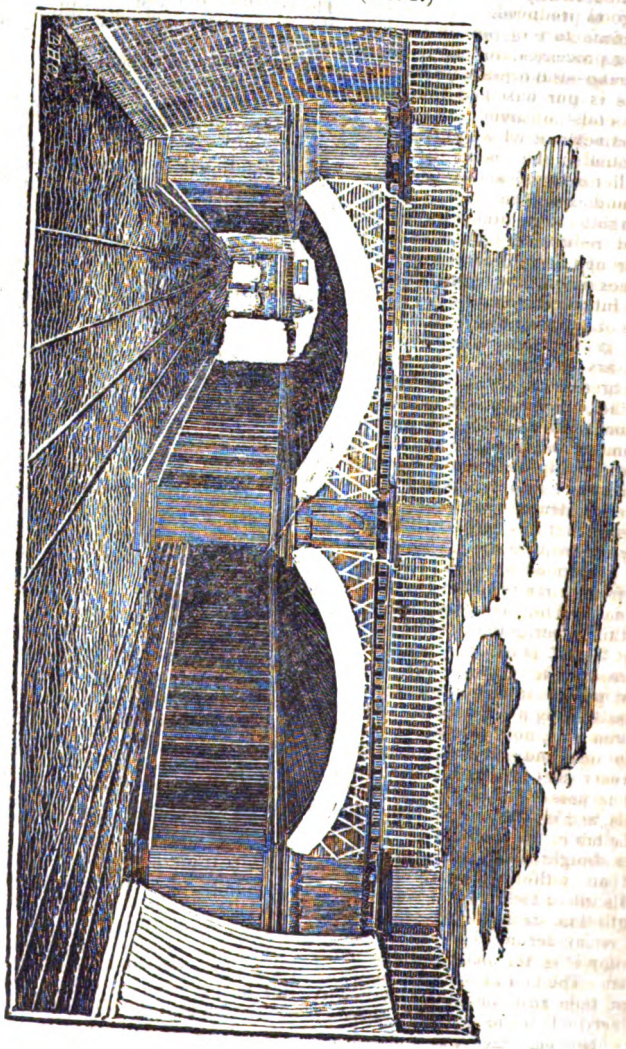
It is an old saying, "When the horse is stolen, the stable door is locked;" and as "prevention is better than cure," we beg to offer a remark on the safety of travelling on some parts of the line. Every person who is in the habit of travelling on railways, must be aware that the engine does at times get off the rails. Now if this happens where there is no embankment to fall over, or any projection opposed to it, the only disagreeable arising from it would be the loss of time. But should it happen when approaching a bridge, the consequences can hardly be calculated upon. A train of carriages flying along at the rate of thirty miles an hour, and the engine getting off the rails, when near one of the piers, it would be impossible to check the speed before it would come in contact, and be dashed to pieces. This, in our opinion, might be easily guarded against, by a strong granite slope, or starling (all our bridges on the Thames are protected in this way), in front of the pier. Should the engine then get off the line, it would ascend the inclined plane but a short distance before it would be brought down again by its own gravity, and thus kept in a safe channel.

We are sorry that we cannot afford our readers many particulars of the statistics of this Railway. We have applied to Mr. Creed, the secretary, for the customary information, but he has had the politeness to allow our note to remain unanswered. We perceive that other persons have been treated in a similar manner; but we hardly think that such incivility to persons connected with the press, will be

Digitized by Google

beneficial to the interests of the Company. We have been able to learn, however, that the expense of levelling, excavating, tunnelling, filling up, &c., averages 60,000*l.* per mile. One mile alone, between Primrose-hill and Camden-town, cost 300,000*l.*, in consequence of the extraordinary difficulties which had to be overcome. The masonry at the mouth of the tunnel by Primrose-hill, will cost 7000*l.* It is composed of the finest Portland stone, and when completed it will have a very handsome effect. Labourers' wages amount every week to about 40,000*l.* The total amount of capital invested in this speculation, is estimated at 7,000,000*l.* and upwards. When the whole is completed, it is expected we shall be able to reach Liverpool in eight hours and a half.

Our engraving below represents a view of the bridge across the Hampstead-road. The one given in our front page is a correct sketch of the first class engine (No. 1.)



Digitized by Google

# MANUFACTURES.

## PIN-MAKING.

**The advantages of a division of labour are well exemplified in the following description of the process of Pin Making. We have before adverted to the evil effects produced on the minds of persons employed for any length of time in one process; but the advantages, in a commercial point of view, are so great, that it appears the evil must be endured for the sake of the greater good produced.**

In the manufacture of pins in England the following processes are employed:—

*Wire-drawing*—the brass wire used for making pins is purchased by the manufacturer in coils of about twenty-two inches in diameter, each weighing about thirty-six pounds. The coils are wound off into smaller ones of about six inches diameter, and between one and two pounds weight. The diameter of this wire is now reduced by drawing it repeatedly through holes in steel plates, until it becomes of the size required for the sort of pins intended to be made. During the process of drawing the wire through the holes it becomes hardened, and it is necessary to anneal it in order to prevent its breaking; and to enable it to be still further reduced, it is annealed two or three times, according to the diminution of diameter required. The coils are then soaked in sulphuric acid, largely diluted with water, in order to clean them, and are then beaten on stone, for the purpose of removing any oxidated coating which may adhere to them. This process is usually performed by men, who draw and clean from thirty to thirty-six pounds of wire a day. They are paid at the rate of five farthings per pound, and generally earn about 3*s.* 6*d.* per day.

*Straightening the Wire.*—The coil of wire now passes into the hands of a woman, assisted by a boy or girl. A few nails, or iron pins, not quite in a line, are fixed into one end of a wooden table about twenty feet in length; the end of the wire is passed alternately between these nails, and is then pulled to the other end of the table. The object of this process is to straighten the wire, which had acquired an uniform curvature in the small coils into which it had been wound. The length thus straightened is cut off, and the remainder of the coil is drawn into similar lengths. About seven nails or pins are employed in strengthening the wire, and their adjustment is a matter of some nicety. It seems, that by passing the wire between the first three nails or pins, a bend is produced in an opposite direction to that which the wire had in the coil; this bend, by passing the next two nails, is reduced to another of larger curvature in the first direction, and so on till the curvature is at last so large that it may be confounded with a straight line.

*Pointing.*—A man next takes about three hundred of these straightened pieces in a parcel, and putting them into a gauge, cuts off from one end, by means of a pair of shears, moved by his foot, a portion equal in length to rather more than six pins. He continues this operation until the entire parcel is reduced into similar pieces. The next step is to sharpen the ends; for this purpose the operator sits before a steel mill, which is kept rapidly revolving; and taking up a parcel between the finger and thumb of each hand, he passes the ends before the mill, taking care with his fingers and thumbs to make each wire slowly revolve upon its axis. The mill consists of a cylinder about six inches in diameter, and two and a half inches broad, faced with steel, which is cut in the manner of a file. Another cylinder is fixed on the same axis at a few inches distant; the file on the edge of which is of a finer kind and is used for finishing off the points. Having thus pointed all the pieces at one end, he reverses them, and performs the same process on the other. This process requires considerable skill, but it is not unhealthy; whilst the similar process in needle-making is remarkably destructive of health. The pieces, now pointed at both ends, are next placed in gauges, and the pointed ends are cut off, by means of shears, to the proper length of which the pins are to be made. The remaining portions of the wire are now equal to about four pins in length and are again pointed at each end, and their ends again cut off. This process is repeated a third time, and the small portion of wire left in the middle is thrown amongst the waste, to be melted along with the dust arising from the sharpening It is usual for a man, his wife, and a child, to join in performing these processes; and they are paid at the rate of five farthings per pound. They can point from thirty-four to thirty-six and a half pounds per day, and gain from 6*s.* 6*d.* to 7*s.*, which may be apportioned thus: 5*s.* 6*d.* the man, 1*s.* the woman, 6*d.* to the boy or girl.

*Twisting and Cutting the Heads.*—The next process is making the heads. For this purpose a boy takes a piece of wire, of the same diameter as the pin to be headed, which he fixes on an axis that can

Digitized by Google

be made to revolve rapidly by means of a wheel and strap connected with it. This wire is called the mould. He then takes a small wire, which having passed through an eye in a small tool held in his left hand, he fixes close to the bottom of the mould. The boy now cuts the end of the spiral connected with the foot of the mould, and draws it off. When a sufficient quantity of heading is thus made, a man takes from thirteen to twenty of these spirals in his left hand, between his thumb and three outer fingers; these he places in such a manner that two turns of the spiral shall be beyond the upper edge of a pair of shears, and with the forefinger of the same hand he feels these two projecting turns. With his right hand he closes the shears; and the two turns of the spiral being cut off, drop into a basin. The position of the forefinger prevents the heads from flying about when cut off. The workmen who cut the heads are usually paid at the rate of 2½*d.* to 3*d.* per pound for large, but a higher price is given for the smaller heading. Out of this they pay the boy who spins the spiral; he receives from 4*d.* to 6*d.* a day. A good workman can cut from six to about thirty pounds of heading per day, according to its size.

*Heading.*—The process of fixing the head on the body of the pin is usually executed by women and children. Each operator sits before a small steel stake, having a cavity, into which one half of the intended head will fit; immediately above is a steel die, having a corresponding cavity for the other half of the head: this latter die can be raised by a pedal moved by the foot. The cavities in the centre of these dies are connected with the edge by a small groove, to admit of the body of the pin, which is then prevented from being flattened by the blow of the die. The operator with his left hand dips the pointed end of the body of a pin into a tray of heads; having passed the point through one of them, he carries it along to the other end with the fore finger. He now takes the pin in the right hand, and places the head in the cavity of the stake, and, lifting the die with his foot, allows it to fall on the head. This blow tightens the head on the shank, which is then turned round, and the head receives three or four blows on different parts of its circumference. The women and children who fix the heads are paid at the rate of 1*s.* 6*d.* for every twenty thousand. A skilful operator can with great exertion do twenty thousand per day; but from ten to fifteen thousand is the usual quantity: children head a much smaller number; varying, of course, with the degree of their skill. The weight of the hammer is from seven to ten pounds, and it falls through a very small space perhaps from one to two inches. About one per cent. are spoiled in the process; these are picked out afterwards by women, and are reserved with the waste from other processes for the melting-pot. The form of the dies in which the heads are struck is varied according to the fashion of the time; but the repeated blows to which it is subject renders it necessary that it should be repaired after it has been used for about thirty pounds of pins.

*Tinning.*—The pins are now fit to be tinned, a process which is usually executed by a man, assisted by his wife or by a lad. The quantity of pins operated upon at this stage is usually fifty-six pounds. They are first placed in a pickle, in order to remove any grease or dirt from their surface, and also to render that surface rough, which facilitates the adherence of the tin with which they are to be covered. They are then placed in a boiler full of a solution of tartar in water, in which they are mixed with a quantity of tin in small grains. They are generally kept boiling for about two hours and a half, and are then removed into a tube of water into which some bran has been thrown; this is for the purpose of washing them. They are then taken out, and, being placed in wooden trays, are well shaken in dry bran: this removes any water adhering to them; and by giving the wooden tray a peculiar kind of motion, the pins are thrown up, and the bran gradually flies off, and leaves them behind in the tray. The man who pickles and tins the pins usually gets one penny per pound for the work, and employs himself, during the boiling of one batch of pins, with drying those previously tinned. He can earn about 9*s.* per day; but out of this he pays about 3*s.* for his asistant.

*Papering.*—The arranging of pins side by side in paper is generally performed by women. The pins come from the last process in wooden bowls, with the points projecting in all directions. A woman takes up some, and places them on the teeth of a comb, whilst, by a few shakes, some of the pins fall back into the bowl, and the rest, being caught by their heads, are detained between the teeth of the comb. She then fixes them between two pieces of iron having 25 grooves; and presses them into the paper as sold.

Digitized by Google

# THE CHEMIST.

## AFFINITY.

The term affinity is used to explain the peculiar attraction exerted by the particles of which different substances are composed on each other, when brought within certain limits of contact. Every atom of matter, whether as an individual atom, or in a state of aggregation, attracts other atoms, and it was the discovery of the laws by which this power is governed, when acting on such bodies as the sun, earth, &c., that obtained for Sir I. Newton the great reputation to which he was entitled in consequence of the discovery. It is the attraction of the sun for the earth and other planets, that prevents those bodies flying off into space, instead of revolving round that luminary as they now do. The attraction, however, between bodies is mutual, and the reason of one having more power than another, is only in consequence of its containing a greater quantity of matter: this is well exemplified in the case of the moon and the earth. The latter body being the larger, causes the former to revolve around it, instead of flying off, as it otherwise would do; at the same time the moon attracts the earth to a certain extent, and produces the well known phenomenon of the tides, which are caused in consequence of the water being raised over a particular part of the earth, under the influence of the moon's attraction. This attractive power of matter, according to the circumstances under which it operates, is termed gravity; the attraction of cohesion; capillary attraction; and chemical affinity. The first acts between bodies situate immensely distant from each other; but cohesion, capillary attraction, and affinity, only exercise their power at imperceptible distances.

The affinity between the atoms of some substances is very great, and *vice versa*; thus, sulphuric acid and water have so strong an affinity for each other, that when mixed together, they occupy less space than they did previously, in consequence of their particles being brought into closer contact. Oil and water, on the contrary, cannot be made to combine, because they have no affinity for each other. If some of each be shaken together, they may for a time appear to mix, but directly the mixture is allowed to stand, the oil will ascend to the top of the water, which will remain unchanged at the bottom.

The term elective affinity is employed in order to designate the choice or election which bodies appear to make in forming compounds with other bodies. The following old, but good, because striking experiment, may be performed to illustrate the different affinities of different substances. Pour a little oil and a little water into a phial, no chemical action will ensue, for the reason we have stated; but if a small quantity of an alkali,—hartshorn (ammonia), or solution of caustic potash,—be added to the mixture, a compound of the alkali and oil will be formed, constituting a substance almost the same as common soap, and which being soluble in water, will form soap and water. Now sulphuric acid has a stronger affinity for the alkali than the latter for the oil, and if we pour a little of the acid in the mixture, the acid and alkali will combine together, while the oil will be liberated, and float on the water. A second experiment, to illustrate the same fact, may be performed as follows:—Place a piece of camphor in some alcohol, and after a little time, in consequence of their affinity for each other they will combine, and the mixture become as transparent as it was before the camphor was placed in the alcohol. Water has a stronger affinity for the spirit, however, than the camphor has, and, consequently, if a little be introduced into the mixture, the alcohol will combine with it, and the camphor will be precipitated. Both these experiments may be performed with a phial, and can, therefore, be practised by all our readers; and we advise each of them who wish to understand the principles of chemistry, to determine every thing by experiment, as, unless they do so, they will make but little progress.

For a long time it was considered by chemists, that a compound body could never be decomposed by a substance having a weaker affinity for either of the constituents than they had for each other; but it has since been found that such an event can and often does take place. In the following instances, as well as in many others, a substance possessing a weaker attraction, displaces another, having a stronger for a third body:—

Potash separates sulphuric acid from barytes.
Lime separates sulphuric acid from potash.
Potash separates oxalic acid from lime.
Nitric acid separates lime from oxalic acid.
Potash seperates phosphoric acid from lime.
Potash separates carbonic acid from lime.
Soda separates sulphuric acid from potash.*

* In the above table, the body first mentioned decomposes a compound of the second and third, although its attraction for the second is inferior to that of the third.—Dr. Henry.

Digitized by Google

The truth of the above may be verified by experiment; and Berthollet explains the circumstance by supposing, that the intensity of the action between any two bodies, depends on their *quantity*, as well as on the peculiar affinity of the atoms for each other; and, consequently, that a great quantity of any substance of weak affinity, may overcome the stronger affinity of a smaller quantity. Hence a larger quantity of one of the substances may compensate a weaker affinity and the reverse.

There are various other circumstances that influence the effects of chemical affinity; but it is not necessary to take them into consideration in order to understand the principle. It will be found to hold as a general rule, that a body having a strong affinity for any substance, will decompose it from a combination with others of weaker affinity. The following table will explain the manner in which this may take place with one compound—muriatic acid: the substance which it attracts most strongly, is placed nearest to it, and that for which it has the least affinity at the bottom:—

*Muriatic Acid.*
Barytes
Potash
Soda
Lime
Ammonia
Magnesia.

In systems of chemistry, a variety of tables similar to the above are generally inserted, and it is useful for the student to prove their accuracy by experiment, since a knowledge of the affinities of different bodies make the chemist. It is from knowing what substances will decompose others, that we are enabled to analize bodies, and within the last few years an astonishing progress has been made in this branch of science. An approximation to truth was once thought sufficient; now the chemist is expected to determine the constituents of a compound to a grain.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Aug. 23, T. Webster, esq, on Geology; Friday, 25, John Hemming, esq., on Chemistry, at half-past eight o'clock.

*Aldersgate Street Literary and Scientific Institution.*—Wednesday, Aug. 23, Charles Cowden Clarke, esq., on Early English Poetry, at eight o'clock.

*Eastern Athenæum*, Stepney-square.—Wednesday, Aug. 23, G. Francis, esq., on Botany, at half-past eight o'clock.

*Saint Pancras Institution*, Colosseum House, New-road.—Tuesday, Aug. 22, Mr. King on the Anatomy of the Senses, at half-past eight o'clock.

*Westminster Mechanics' Institution*, 5, Little Smith street.—Thursday, Aug. 24, A. Parsey, esq., on Perspective, rectified with illustrations, at half-past eight o'clock.

*Islington Scientific Institution*, 7, Clark's-place, High-street.—Thursday, Aug. 24, Mr. James Smith on the Production and Distribution of Wealth, at eight o'clock.

*Bermondsey Mutual Instruction Society*, British School-room, Great George-street. — Monday, Aug. 14, Mr. R. F. Showler, on Aeronautics, at half-past eight o'clock.

*Tower Street Mutual Instruction Society.*—Monday, Aug. 21, Mr. Devonport, Lecture on the Elements of Society, at eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, Aug. 22, Mr. Dalton on the Steam Engine, at half-past eight o'clock.

### ANSWERS TO QUERIES.

*To Tin Iron.*—Sir, I beg to answer, through the medium of your journal, W.S.'s query. Metal to be tinned must be cleansed, if new work, by putting it in a pickle,—a mixture of sulphuric acid and water,—then scoured with sand, and cleansed in water; but if old, the pickle should be a mixture of muriatic acid and water. It is then ready for tinning. He should place the article on the fire, and apply sufficient heat to melt the tin. Care should be taken that too great a heat should not be applied, or you will burn the article; it must be rubbed well with a piece of sal ammoniac placed between two wires, likewise some powder sprinkled upon it, to keep the metal from oxidating; apply the tin, wipe it over with a piece of tow, then the work is finished.

A CONSTANT READER.

### TO CORRESPONDENTS.

*Correspondents are in future requested to direct their Letters* "To the Editor, AT THE PRINTER'S, Holloway Press, Islington." *All communications to be Post Paid.*

Mr. Payne's *drawings of his* Coffer Dam *have been in the hands of our Engraver for some time, but are unfortunately mislaid. Can* Mr. Payne *favour us with copies?*

Jackson's Air Pump *shall appear in our next.*

W. H. *shall be inserted in No.* 44.

W. L. Clements *shall be attended to.*

*We feel obliged for the List of Lectures from the Westminster Institution; also, for the Pamphlet on the "Benefits of General Knowledge."*

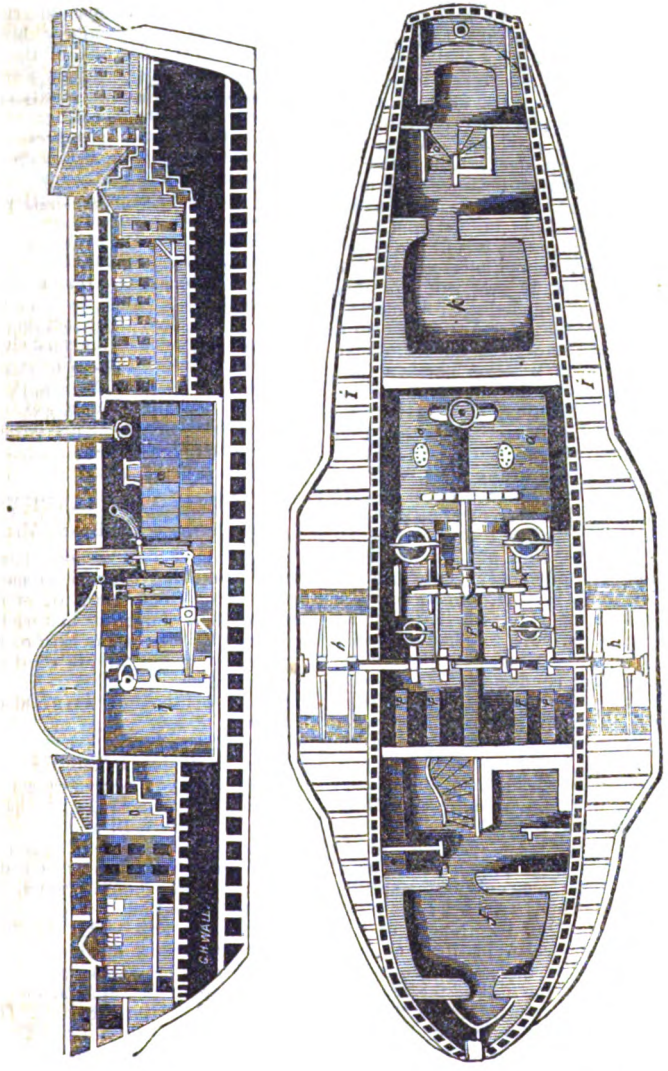
London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. XLIV.] SATURDAY, AUGUST 26, 1837. Vol. II.


STEAM BOAT ENGINES.




Vol. II.—No. XLIV.

Holloway Press: D. A. Doudney.



Digitized by Google

## STEAM-BOAT ENGINES.

In the early constructed steam-boats, only one steam cylinder was employed, but now it is the invariable custom to use two steam cylinders; each of which is made to work a crank upon the axle of the paddle wheels. The cranks are at right angles to each other, so that when one is passing the dead point, the other is exerting its utmost force. In America the engines are usually on the high-pressure plan, and the boilers, as well as the principal part of the machinery, upon deck. In British steam vessels, the engines are principally constructed on the low-pressure condensing principle, and the machinery all below deck. The latter circumstance renders it indispensable to diminish the height of the engines, and to transfer the working beams from above the cylinders to beneath them. To reduce the height also, the cylinders are made of greater diameter, in proportion to their length, than in land engines. A tolerably correct idea of the general arrangement of the machinery, as well as the various accommodations in a steam passage boat, will be afforded by the figures on the previous page. The upper figure represents a longitudinal and vertical section, from stem to stern, of a steam-vessel; and the lower figure a plan of the same, with the deck removed; similar letters in each figure refer to the corresponding parts.

*a a* are two boilers; *b* the chimney, leading from the flues of both the fires; *c* is the steam pipe, only partly brought into view in the section, but its course is better seen in the plan, where it is shown to proceed from both the boilers into a single tube, which conveys it into another cross tube, that connects it to the two cylinders *d d*, by the intervention of the valve boxes *f f*. The air pumps *e e*, are worked by the main beam, and the eccentric, for giving motion to the valves is shown at *g*. The paddle-wheels *h h*, are usually attached to the main crank by a coupling-box, or toothed wheels, which enables the engineer to throw off either of the propelling wheels at pleasure; *i*, one of the paddle-boxes, seen only in the section. *j* is the fore-cabin, *k* the after-cabin, *o o* the staircases; *l l l l* the framing of timber which supports a platform or deck (commonly called the gangway), which nearly surrounds the hull of the vessel.

The American steamers are for the most part fitted up with more extensive and splendid accommodations than our own. The dining-room of *The North America* is described as being 150 feet in length, and to be capable of dining from 700 to 1000 passengers! The floors are covered with the finest carpets; the curtains of damask silk, and the ornamental work elaborately carved, and richly gilt. The walls are hung with the works of celebrated artists, &c. The fare from New York to Albany, including three meals, is four dollars. It is usually performed (144 miles), within twelve hours, including stoppages in the voyage at ten or twelve different places. There being no machinery below, the whole extent of the hull of the vessel is left open for those various commodious arrangements, which in reality constitute an American steamer a grand floating hotel. The British steamers being, on the contrary, built to sustain the waves of the ocean, are differently constructed. A good example of the construction of steamers in this country is afforded by *The United Kingdom* packet from London to Leith, which is usually performed in from 40 to 50 hours. She measures 148 feet in the keel, and the breadth of her beam is 45 feet. The accommodations for passengers are of the most elegant and convenient description. She is propelled by two engines of 100-horse power each (constructed by Mr. Napier, of Glasgow), which are considered as specimens of very superior workmanship.

## IMPROVED ALARUMS.

*To the Editor of the* PENNY MECHANIC.

SIR,—I have been somewhat amused of late, in perusing the almost abortive description of clock alarums, as given by some of your numerous and talented correspondents, and cannot help pointing out a slight oversight in the construction of their alarums. It is this:—After the descending weight may have unlocked the trap, and it has "gone off," that there will not be sufficient power in the mechanism of the bell to keep up a continued ringling for any time; it cannot possibly make any more noise than the quick ring of an ordinary bell, and therefore will not answer the purpose of your alarmists. A very good alarum may be had in any Dutch clock for about 5*s.* extra, that will keep up a continued ringing for nearly three minutes, and wake the most soporific at two rooms distance. I have one that only cost me 5*s.* that will do it; and what is another advantage, they can be set to *any time* without trouble. The noise mine makes is so great, that I always curtail it by making the string shorter. Besides, only consider the unsightly appearance of the trap-board and common bell stuck against the wall under the clock,

Digitized by Google

and the liability of stopping the pendulum or entangling the ropes. It should be neat and out of sight, and it ought not to require a second bell to clatter with; the striking bell is quite sufficient. And should the clock itself be not actually required, an alarum of the same principle might be made, by hanging a tube or glass with a hole in the bottom for silver sand to fall through into a cup, or something *on the trap*, so that the accumulating weight of the sand would make the trap fall and the bell jingle; of course the sand must be sufficient to run for the required time, and in weight sufficient to force the trap down.

These are the objections I have against these alarums, and do not wish to depreciate the *inventions* of your correspondents, but only to give them a hint or two at neatness. As to the great economy, I do not see any; the trouble of setting and regulating the machine is considerable; this should be avoided. There is not any in the alarums I allude to. The insertion of this may open the eyes of your correspondents, and "*awake*" them in time to save the trouble of making such a machine, if they are ever so soporific; and oblige an old friend in a new dress.

JINGLE.

## AEROSTATION.

NO. III.

HAVING thus related what has been done with regard to the conducting of aerostatic machines through the atmosphere, I shall now relate the attempts that have been made to lessen their expense, by falling upon some contrivance to ascend without throwing out ballast, and to descend without losing the gas. The first attempt of this kind was made by the Duke de Chartres, on the 15th July, 1784. The balloon was of an oblong form, made to ascend with its longest diameter horizontally, and measured 55 feet long, and 24 wide. It contained within it a smaller balloon filled with common air, by blowing into which with a pair of bellows, and thus throwing in a considerable quantity of common air, it was supposed that the machine would become sufficiently heavy to descend. By inflation of the internal bag, the inflammable air in the external one would be condensed into a smaller space, and thus become specifically heavier. The power of ascent with which they set off, seems to have been very great, as in three minutes after leaving the earth, they were lost in the clouds, and involved in such dense vapour, that they could see neither the sky nor earth. In this situation they seemed to be attacked by a whirlwind, which turned the balloon three times round, from right to left, and beat it so about, that they were unable to use any of the means proposed for directing their course. The diminished density of the atmosphere had also such an effect on the gas, that the balloon seemed every moment ready to burst, to prevent which, the Duke bored two holes in the balloon, which tore open seven or eight feet. On this they descended with great rapidity, and would have fallen into a lake, had they not thrown out 60 lbs. of ballast, which enabled them just to reach the water's edge. This method of constructing balloons having, therefore, proved unsuccessful, another was tried. This was to put a small aerostatic machine, with rarefied air, under an inflammable air balloon, but at such a distance, that the inflammable air of the latter might be perfectly out of reach of the fire used for inflating the former, and thus by increasing and diminishing the fire in the small machine, the absolute weight of the whole would be considerably diminished or augmented. The scheme was unhappily tried by M. Pilatre de Rozier, and another gentleman named Romaine. Their inflammable air balloon was about thirty-seven feet in diameter, and the power of the rarefied air one was equivalent to about 60 lbs. They ascended without any appearance of danger, but had not been in the air long, before the whole of the machine was on fire. The air balloon continued expanded, and seemed to resist the atmosphere for about a minute, after which it collapsed, and the remains of the apparatus descended along with the two unfortunate travellers so rapidly, that both of them were killed. After this, M. Blanchard and Dr. Jeffries made a voyage across the Straits of Dover. As the balloon was scarcely sufficient to carry two, they were obliged to throw out all their ballast, except three bags of 10 lbs. each, when they at last rose gently, though making very little way, on account of there being very little wind. At a quarter after one, the barometer, which on the cliff stood at 29·7, had fallen to 27·3, and the weather proved fine and warm. After passing over several vessels, they found the balloon at fifty minutes after one was descending, on which they threw out a sack and a half of ballast; but as it still descended, and with greater velocity, they threw out all the ballast; this not being enough, they threw out a parcel of books which they had with them when the bal-

Digitized by Google

loon ascended. At a quarter past two they found themselves again descending; they then threw away the remainder of their books, still, however the balloon descended, and they were obliged to throw away their provisions, the wings of the boat, and every other moveable they could easily spare. All this proving inefficient to stop the descent of the balloon, they next threw out their anchors and cords, and at last stripped off their clothes, fastening themselves to certain slings, and intending to cut away the boat as the last resource. They had now, however, the satisfaction to find that they were rising; as they passed over the high lands between Cape Blanc and Calais, the machine rose very fast, and carried them higher than they had been during the voyage. They descended safely in the forest of Guiennes. Since that time till the present, but few alterations have been made in the form of balloons; nor has any great advance been made in the science of aerostation, by which the dangers of ascent and descent may be removed or lessened.

C. H. S.

## BIOGRAPHICAL SKETCHES.

### ALEXANDER WILSON.

(*Continued from page* 13.)

Up till this period, and indeed for several years after, Wilson exhibited no indications of a genius or even predilection for that particular department of natural history in which he afterwards acquired so brilliant a name, but it is said, that immediately after landing in America, and while proceeding from the place of his disembarcation to Newcastle, his attention was strongly excited by the specimens of the feathered inhabitants of the New World which he met with, and that he was particularly delighted with the splendour of the plumage of a red-headed woodpecker, which he shot by the way. Whether or not his genius received on this occasion that bent which afterwards led to such splendid results, it is certain that he always retained a lively recollection of the feelings of surprise and delight with which he for the first time contemplated the beauties of the American woodpecker.

For many years after his arrival in America, Wilson's condition underwent but little improvement. He found there nearly the same difficulties to contend with, and prospects nearly equally cheerless, with those he left behind him in his native land. The first employment he obtained was with a copperplate printer in Philadelphia, but this he soon relinquished, and betook himself to his original trade, weaving. This he again resigned for the pack; but his success as a pedlar was not sufficient to induce him to continue by it, and he abandoned it also, and commenced teacher; making his first experiment in this laborious and somewhat precarious profession near the town of Frankford in Pennsylvania. While in this situation, he in a great measure repaired the defects of his early education, by close and unremitting study in various departments of science and knowledge, and, as has often been the case, by instructing others he taught himself. He afterwards removed to Milestown, where he remained for several years, adding a little to the limited income arising from his school, by surveying land for farmers.

At the end of this period he applied for and obtained the appointment of schoolmaster of the Union School in the town-ship of Kingsessing, within a few miles of Philadelphia; and it is from this period that his history in the pursuit of the bird creation commences, although he yet entertained that branch of natural history only in common with others, and by no means confined his studies to the feathered tribes. His attention was equally engrossed by a host of other animals; and his apartment, as described by himself, had the appearance of Noah's ark, being crowded with opossums, squirrels, snakes, lizards, and other animals. Finding his ignorance of drawing a serious desideratum in his new pursuit, he applied to the acquisition of this art with such diligence and determination of purpose, that he in a very short time succeeded in obtaining a command of the pencil, that enabled him to sketch from nature with great fidelity and spirit. It was not, however, till the year 1803, that Wilson conceived the magnificent design of his American Ornithology, and even then his ideas on the subject fell very far short of the great work he afterwards achieved. At this period he contemplated little more than "making a collection of the finest American birds," as he himself writes to a friend in Paisley. Having mentioned his intention to some of his American friends, they endeavoured to dissuade him from prosecuting it, and, with a sincere regard for his interest, pointed out to him the formidable difficulties which he would have to encounter, and which appeared to them insurmountable. But they spoke in vain. Wilson's

Digitized by Google

ardour and enthusiasm was more than a match for their prudence; and trusting to his own resources, he quietly but resolutely proceeded with his design, although, and it is a curious fact, when he began his stupenduous work on American Ornithology, he did not know even the names of more than three or four of the American birds. But from this moment he devoted himself with a zeal and energy to the accomplishment of his enterprise, which removed all obstacles as fast as they presented themselves, and swept away all difficulties as straws are swept away by the stream.

In October 1804, with his gun on his shoulder, he made the first of that series of perilous journies through the wilds of America, which he found it necessary to perform to obtain an accurate and intimate knowledge of the birds of the forest; and amidst privations and hardships which few men but himself would have voluntarily encountered, he completed a journey of twelve hundred miles on foot, through deep snows, boundless forests, deep and dangerous rivers, and over wild and desolate mountains.

## ON IMMATERIAL CAPITAL.

NO. II.

How deplorably ignorant then, must that man be, who looks down upon the genius with a contempt like that of Diogenes, the cynic, upon the conquests of Alexander the Great. It is even too high an honour for him to be classed with that prince of scorners, for in his case there was a vein of true philosophy in the sarcasm that he uttered, whereas the contempt of our modern cynic is the very negation of philosophy and truth. The former sneered at the false glare and splendour of those royal trappings which might have adorned brutes. The latter despises the nobility of the highest attribute of man. How deserving of pity, then, is he who sinks himself so low in the scale of moral being. Let, then, all beware, lest they despise that which none but God has given, and none but he can take away. This patrimony of man is too sacred to be despised as undervalued. Too long, alas, has it been held in contempt; too long has the foul stain rested upon humanity. We trust that the time is coming when it shall be wiped away. When the march of intellect shall sweep as with the besom of destruction, the hideous cobwebs of ignorance from the face of the earth,—when man shall perceive that the medium of circulation, that material capital is only the handmaid of the infinitely more valuable property of the mind. It is in order to this that the present papers are written; and we would endeavour, in our humble sphere, to aid in preparing the world for such a happy consummation. To this end we would endeavour to show, first, the intrinsic value of immaterial capital; secondly, its nominal value; and, lastly, we would suggest some means whereby these may be equalised and brought to par.

The real value of the mind of man it is impossible to estimate, since it is emphatically *invaluable*; it is not to be placed side by side with silver or gold, or any thing that is material; there is no scale of perishable things to which it can be adapted, since it is imperishable and immortal; and the only way of appreciating it at all, is by placing it in relation to something of the like kind. Thus there is the low genius in the stupid man, the common genius in the ordinary man, and the exalted genius in the man of talent; and though these are all adapted to each other, and society, perhaps, could not exist without any one class, yet that is no argument for supposing that all are to be regarded as equal; since the same argument might be applied in reference to material capital, and to those possessed of none, little or much, which would be both absolutely and relatively absurd. Justice, says Cicero, is a rendering to every one his dignity, and if this be the case, not only is a superior mind entitled to more respect than an ordinary one, but its owner has also a claim to every benefit which may accrue therefrom. His mind is his estate.

BASILIUS.

## THE SCIENTIFIC JOURNALS.

*The Edinburgh New Philosophical Journal,* No. 45.

THE first article in this Number will be perused with considerable interest by the readers of the journal; it is the biography of one of its most talented contributors,—Sir John Leslie, written by Macvey Napier, Esq., the editor of the Encyclopœdia Britannica. The article is rather long, consisting of thirty-two pages, but it is written in a style, and contains an accumulation of interesting facts, which cannot fail to render it pleasing, not only to the friends of the philosopher whose memory it will preserve, but to the general reader also. Indeed we have seldom perused a more impartial biography; and though it may not be so attractive as those of philosophers who are better known, its perusal will not be unattended with ad-

Digitized by Google

vantage. The geologist will find many papers of interest to him. An article is taken from Poggendorff's *Annalen* for 1836, on the traces of a vast ancient flood, which at some period, more recent than the Diluvium, must have traversed Scandinavia, in a direction from north-east to south-west. There is also an article "on the account of the Creation in the first Chapter of Genesis," by Mr. Babbage, who considers that the apparent contradiction between Scripture and geological observations, may be reconciled satisfactorily, by supposing that the commencement of the third verse of the first chapter of Genesis, describes the beginning of creation, and that the two former verses refer to a period unknown. "In some old editions of the Bible, where there is no division into verses, you actually find a break at the end of what is now the second verse; and in Luther's Bible (Wittenberg, 1557) you have, in addition, the figure 1 placed against the third verse, as being the beginning of the creation of the first day." In this Number of the journal there are also several papers descriptive of organic remains found at different parts of the world. On natural history and physiology we have several papers deserving attention; one, on the possibility of elucidating the natural history of man by the study of domestic animals, by M. St. Hilaire; and one, on the unity of function in organized beings, we recommend to notice. A paper on the result of an experimental inquiry regarding equivocal generation, we shall transfer to our pages. Dr. Fyfe contributes an article on the use of steam, which will be read with interest, and perhaps advantage, by engineers. The Doctor recommends the introduction of steam into the furnace, and states, that from its decomposition a very powerful heat can be obtained. For the details of his plan, we must refer the reader to the journal itself. M. Goppert, in an article describing the process of petrifaction, states, that an early period it was attempted to explain the phenomenon, by supposing that it took place by means of a liquid containing stony matter, which penetrated the spaces of vegetable and animal bodies, and gradually communicated to them a stony character. The means by which it is promoted in animal bodies is, according to the same view, calcination, and in plants the reduction to earth. M. Goppert has made a variety of experiments on the subject, from which he states that he is authorized to declare with certainty, "that plants rich in potash can never be petrified;" an assumption we are so much the more entitled to adopt, since the experiment with fossil fern proves, how in this respect the vegetation of the ancient would correspond with the vegetation of the present day. The communications in chemical science are not numerous; the principal is one by Van Beek, in reply to some remarks by Dr. John Davy, on the supposed property of tin of preserving iron from corrosion in sea water. Sir Humphrey Davy recommended the use of tin for preserving the iron boilers of steam vessels from corrosion by the sea water used; but Van Beek states, that the results of his experiments show that a piece of iron, when exposed alone to the action of sea water, lost 0·052 grains *less* than that whereon was fixed a small surface of tin, whilst the tin had lost but 0·001 grains. The meteorologist will find a paper interesting to him on the meteoric showers of November, 1836; and the above papers, with a few of minor importance, constitute the contents of the present Number of the journal before us. We much regret to see how few contributors Professor Jameson has to assist his labours. Out of twenty-eight articles, only seven are communicated by their authors. A work of such utility in the scientific world, as "The New Edinburgh Philosophical Journal," ought to be better supported by our philosophers.

*Easy method of Making Beautiful Golden Figures upon Steel.*—Add to a saturated solution of nitro-muriate of gold, about a fourth part of sulphuric ether; shake the mixture, and then allow it to settle. The ether will take the gold from the acid, and will separate itself from it also, and form an upper stratum in the vessel. Carefully pour this etherial gold into another glass, and immerse it in any steel utensil that is highly polished, then take it out, and instantly plunge it into water, when the surface will have acquired a coat of pure gold, the beauty of which may be increased by burnishing. You may use a pen, and draw figures on razors, &c., and the gold will remain in them as just described.

J. R. W.

*Easy Method of Breaking Glass to any required Figure.*—Make a small notch by means of a file on the edge of a piece of glass, then make the end of a tobacco-pipe, or of a rod of iron of the same size, red hot in the fire, apply the hot iron to the notch, and draw it slowly along the surface of the glass in any direction you please, a crack will be made in the glass, and will follow the direction of the iron.

J. R. Watts, M.D.

Digitized by Google

# THE CHEMIST.

## LAWS OF CHEMICAL COMBINATION.

NO. I.

THE laws which regulate the combination of the different substances in nature are not numerous, but they are universal and permanent, and on them rests the whole science of chemistry. Until these laws were understood, it was impossible that any great advance could be made in the science; but with our present knowledge of them, and with the prospect of becoming still better acquainted with their mode of operation, the chemist may look forward to the time when advances will be made, that some few years ago were not even thought possible.

The first important general law is, "that the composition of bodies is definite and invariable; and that a compound body, so long as it retains its characteristic property, must always consist of the same elements united together in the same proportion. For example, sulphuric acid is always composed of sulphur and oxygen in the ratio of 16 parts by weight of the former, to 24 of the latter: no other elements can form it, nor can its own elements form it in any other proportion. Water, in like manner, is formed of 1 part by weight of hydrogen, and 8 of oxygen; and were these two elements to unite in any other proportion, some new compound, different from water, would be the product. The same observation applies to all other substances, however complicated, and at whatever period they were produced. Thus sulphate of baryta, whether formed ages ago by the hand of Nature, or quite recently by the operations of the chemist, is always composed of 40 parts of sulphuric acid and 78 of baryta. When two or more elements unite to form a compound substance, the addition or diminution of a small quantity of one often produces an effect remarkably different to what would have resulted, had the proportions been different; for instance, there is a great dissimilarity, both in taste and appearance, between starch and sugar, and yet they are composed of the same elements, and very nearly in the same proportion, as will be seen by the following analysis:—

| | Oxygen. | Hydrogen. | Carbon. |
|---|---|---|---|
| Sugar.... | 40 | 5 | 36 |
| Starch... | 48 | 13 | 42 |

So that it is only in consequence of the starch containing a few atoms more of its elements than the sugar does, that it differs so materially in its sensible qualities. If we could abstract one atom of oxygen, seven of hydrogen, and one of carbon, from the starch, we should convert i into sugar; and in many chemical processes this effect is actually produced. The following experiment will illustrate the law we have been describing. Sulphate of magnesia (Epsom salts) is composed of sulphuric acid and magnesia. If the latter be added to the acid till it is saturated, it will be found that any magnesia thrown in the sotution afterwards will not combine with the acid, but will be precipitated to the bottom; thereby showing, that only a certain quantity of the magnesia will combine with the acid to form the compound Epsom salts.

The next law of combination is, "that when two bodies combine together in any proportion, the resulting compound is always different in its nature to the substances from which it was produced." Two substances decidedly poisonous, when combined chemically, may produce a compound even necessary to our existence. In like manner, two bodies perfectly innoxious in their natural state, may become an active poison when combined. For example: Common table salt (muriate of soda) is composed of muriatic acid and soda. The muriatic acid, taken internally, causes much agony, and ultimate death; and the caustic alkali, the soda, would produce effects very similar; yet when combined, they produce a substance ranking amongst the first necessaries of life; for without common salt, it would be almost impossible for the body to perform its functions in a healthy manner. As an example of poisons being produced from the combination of substances which in their natural state are not injurious, we may instance the vegetable and animal poisons. The dreaded worali of the Indians, and the pestiferous and destructive upas, to the influence of either of which, animals cannot be exposed without the loss of life, are formed from the same elements as those which produce the luxurious fruits, and the wonderful variety of beautiful flowers that exist in the countries where these poisons are found. In like manner the elementary substances that form the flesh of the deer and oxen, upon which man finds subsistence, are the same as those from which the deadly poison of the rattle snake is elimented; or the no less dreaded virus of canine animals in a state of hydrophobia. Thus it will be seen how Nature, out of a few simple elements, is able to produce such a wonderful variety of substances, whether the result of organization, or produced from the mineral kingdom. When, indeed, it

Digitized by Google

is seen how out of two or three substances, merely from their being combined in different proportions, active poisons or nutritious food can be produced, we think a sufficient reason is offered for those who understand nothing of the science by which this knowledge has been ascertained, to commence at once the study of chemistry.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—I should be obliged to you, or any of your intelligent readers, if they can account for the following phenomenon. On holding a coil of copper wire over the flame of some paper, the colour of the flame was presently changed to a beautiful green, which continued until the wire had attained a red heat, when it ceased to alter the colour of the flame.

Yours truly, L.

SIR,—If any of the readers of your very useful little paper, can answer me the following queries, they will very much oblige A WORKMAN.

What is the best recipe for staining wood (furniture for instance) rosewood colour, and the method of graining the same; and the best varnish for furniture so done?

What is the best mode of French polishing, and the most approved rubber in use?

SIR,—J. F. P. wishes to know the best practical way of finding the length of focus of convex and concave glasses.

### ANSWERS TO QUERIES.

*To the Editor of the* PENNY MECHANIC.

*Stuffed Animals for Specimens.*—The animal being carefully embowelled, the opening for that purpose being made in some place that will be out of sight; as, for example, under the wings of birds, gushes cut in the remaining flesh, and the brain extracted by a wire, the whole of the inside is washed with a ley of common soda, then dried with tow, and afterwards the inside is done over by means of a brush with Becœur's arsenical soap, which is prepared by melting thirty-two ounces of soap in a little water, adding twelve ounces of salt of tartar, and four ounces of quick-lime, then mixing with them thirty-two ounces of white arsenic and five ounces of camphor previously rubbed down with a little spirit of wine, more water is then added to form the whole into a thin gruel. This illinition drives away insects. Larger animals are usually skinned; the internal cavity is then filled with tow, shred tobacco, straw, or this powder tobacco, and powdered black pepper, of each one pound; flowers of sulphur and sal prunellæ, of each eight ounces; burnt alum four ounces, to which may be added an ounce of corrosive sublimate. Fish are sometimes skinned; the skin is then drawn over a mould made of clay, or plaster of Paris, and varnished with spirit varnish. False eyes are made for these specimens by dropping some black sealing-wax upon a piece of card, cut a little larger than the size of the natural eye. For large eyes, common glaziers' putty may be used, and when dry painted of any required colour, baking is not only useful in fresh specimens, but it should be a constant practice to bake them over again once in two or three years, and to have the cases washed with camphoreted spirits of wine.

J, R. WATTS, M.D.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Aug. 30, Dr. Birkbeck on the Muscles and Muscular Motion.—Friday, Sept. 1, John Hemming, esq., on Chemistry, at half-past eight o'clock.

*Aldersgate Street Literary and Scientific Institution.*—Wednesday, Aug. 30, Charles Cowden Clarke, esq., on Early English Poetry, at eight o'clock.

*Eastern Athenæum*, Stepney-square.—Wednesday, Aug. 30, no Lecture.

*Saint Pancras Institution*, Colosseum House, Newroad.—Tuesday, Aug. 29, Mr. Guthrie on the Philosophy of Language, at half-past eight o'clock.

*Westminster Mechanics' Institution*, 5, Little Smith street.—Thursday, Aug. 31, M. Delille on French Literature, at half-past eight o'clock.

*Islington Scientific Institution*, 7, Clark's-place, High-street.—Thursday, Aug. 31, Mr. John Isaac Hawkins, on the Economy of the Eyes, and Use of Spectacles, at eight o'clock.

*Tower Street Mutual Instruction Society.*—Monday, Aug. 18, Mr. Corcoran, Essay on Education, at eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, Aug. 22, Nomination of Officers, at eight o'clock.

## TO CORRESPONDENTS.

*Correspondents are in future requested to direct their Letters* "To the Editor, AT THE PRINTERS, Holloway Press, Islington." *All communications to be Post Paid.*

"C. B." *will find an answer to suit his Query in our last week's Number.*

*We feel obliged to our Correspondent* "J. R. Watts," *for his communications. His Gas-Collecting Apparatus shall appear.*

*We have inserted* "W. H. N.'s" *Query again, as we cannot find the answer.*

*Received* G. D. S.—Basilius.—L. Wallington.—R. O****D.

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. XLV.] SATURDAY, SEPTEMBER 2, 1837. [Vol. II.

*Fig* 1.

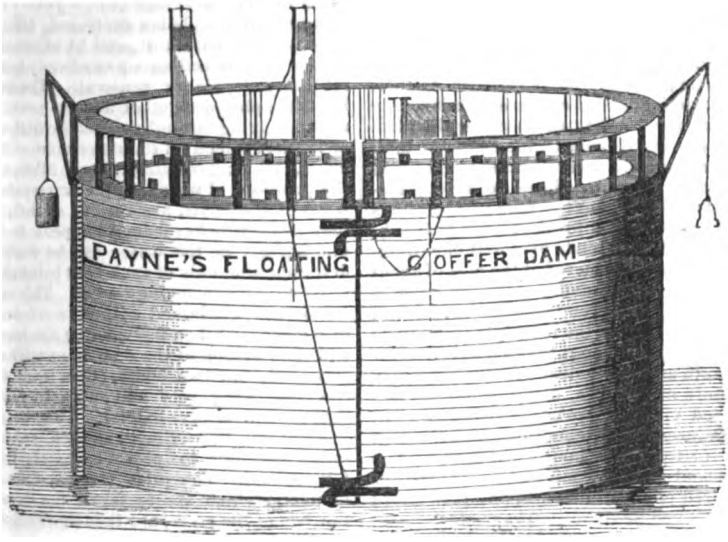
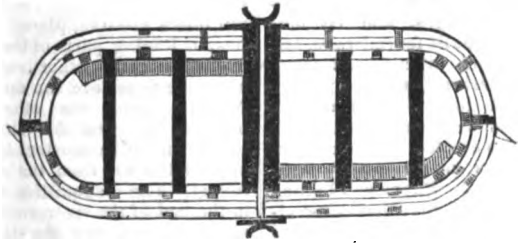



*Fig.* 2.



Vol. II.—No. XLV. Holloway Press: D. A. Doudney.

Digitized by Google

## PAYNE's FLOATING COFFER DAM.

*To the Editor of the* PENNY MECHANIC.

THE old system in bridge building of employing a caisson—a floating vessel, the bottom of which became the foundation and received the first portion of a pier,—is so generally exploded that, in considering the merits of any new invention for laying foundations under water, it is only necessary to compare the novel scheme with the present established use of Coffer Dams. Those now in use appear capable of affording all the strength and convenience required by the engineer and workmen for laying foundations under water, but there are two great objections to them; the enormous expense of their construction, and the loss of time in piling and removal. To calculate the time lost in removing it must be remembered that, where there are several piers, one Dam is generally taken to pieces to supply materials for the next. One of the Dams lately constructed for the repair of Blackfriars-bridge consists of about one thousand piles, constructed at the cost of about five thousand pounds, and occupying 6 months in driving, and 2 months in removal. A Coffer Dam, on the principle about to be described, having equal and if not superior strength and convenience for the workmen to those now in use, could be placed and cleared within a week from being brought to its location; it could be removed in a day or two, and instead of costing five thousand pounds, might be hired at one hundred pounds a month, and then afford a handsome profit to its proprietor.

It is proposed then, by this new Coffer Dam, to avoid both the great objections to the present system, and if it can be established, that both time and money can be saved, there can be no doubt of the plan being adopted, as soon as the usual prejudice in favour of tried means, and against unpractised schemes, shall have worn away. It may be considered probable that more bridges, and viaducts over rivers, will be built for railways, and other improvements in communication, in Europe and America, during the present century, then the total number now in use. It may also be asserted that more bridges would be erected if the cost of laying foundations under water were materially lessened. Payne's Floating Coffer Dam, (of which the Engraving although not made to a scale, conveys a correct idea,) is to be built in a shipwright's launching yard, in two parts, (to be called *boats*) but when floated will be joined in the manner hereafter described, and conveyed, by a steam tug, to the place of its destination. Each of the two parts, or *boats*, of which the Dam is formed, is of the shape of an elongated crescent with the interior part cut away. When joined together they form an oblong, the length of which is twice the measurement of the breadth. These *boats* are flat-bottomed, and are built sufficiently high to permit their being sunk in the deepest river, with their upper works and decks standing out of the water.

This Coffer Dam is built in two distinct parts for the advantage of being easily removed, without being destroyed, after a pier is built within it, and to afford the means of surrounding a pier already built, requiring repair or removal. The two boats are closed together first by means of ropes, running through substantial timbers, or horns, (placed on the outer sides of the boats,) which dovetail with each other, and the positions of which, on the two separate sides of the boats, are varied, so that, as they float, whichever boat happens to be the highest in the water can be worked first; one side only of each boat being supplied with the fastening tackel. This cannot be well explained without a reference to a model. When fastened by the horns, and the position of the dam is exactly ascertained, the two boats, (then being one machine,) are placed and sunk, by filling them with heavy ballast. The barges which carry this ballast are then fastened round the dam to prevent vessels from falling foul. The piles (twenty-four in number,) which are to fasten the dam to the bed of the river, are then driven home by steam power from an engine which is movable, on a tram way, round the decks of the boats; two piles being driven at the same time. The piles are on the interior side of the dam, placed in iron sockets, at regular distances, the sockets being attached to the boats. The dam is not yet water tight: to effect this two flat plates, or shutters, of iron or wood, are put down grooves, placed at the extremities, or joining parts of the two boats, and over these plates other iron shutters, of a half tube form, are run down, in grooves separate from the others, the space between the first flat shutters and the second half tube shutters being filled with clay, let down from the deck through a funnel. The inequalities to be expected in the bed of the river are then to be provided against, and the dam made watertight round the bottom. This is to be done by a number of shutters, of iron and wood, which lap over each other, and have handles running through sockets to

Digitized by Google

the deck, where they can either be driven home by a few strokes from a shipwright's mallet, or be raised from the bed of the river by a rope and pulley. Nothing is now wanting to render the dam completely water-tight, but clay to fill up the interstices between the shutters and the sides of the boats. The following is the contrivance for supplying these parts with any quantity either of clay, sand, or resinous composition. The interior of the dam, or inner circle of the two boats, is supplied with two sides; one of sheathing timbers, rendering the boats water-tight, of the same make as the sheathing timbers of a ship, with the exception that they are on the inner side of the frame or skeleton timbers instead of the outside: the other of sheet iron, covering the wooden side at such a distance as to allow the piles to run in their sockets, as well as to afford room for the frame timbers. The piles are of the same number as the frame timbers, and between each pile there is a space, forming a square funnel, down which any quantity of clay, sand, or resinous composition can be thrown from the deck. The dam is then water-tight, and can be pumped clear by the fixed pump and the movable steam engine.

The two boats forming the dam have each an exterior ladder, an interior staircase, and a crane; and one of the boats has the piling machinery, a pump and the steam-engine. Upper works run entirely round the decks, for the convenience of hoisting pullies and other tackle, and by means of the tram way on deck the steam engine can be removed from one pile to another, or from one crane to the other, thus performing its operations in the most convenient situations.

When it is considered that the entire apparatus for forming the dam, driving the piles, making the dam water-tight, and pumping it clear, is brought to the required site in two parts only, with the piles for fastening down the machine in their regular positions, and the steam-engine in working order, before even the position of the dam is taken up, it may readily be supposed that the machine may be fixed, the piles driven, the dam made water-tight, and cleared for the workmen in four or five days. And when the whole is required to be removed a few hours will suffice to float the two boats, which operation will be nearly sufficient for raising the piles and the shutters. When raised, the entire dam can be taken away, and refixed for another pier, without addition or repair. The objection may perhaps be raised that no provision is made against an accidental blowing of water from under the boats, or when it is necessary to excavate the bed of the river, say ten or fifteen feet, previous to laying a foundation: in answer to which it is submitted that this coffer dam, when once piled home, would be so firm that any work capable of being performed in a common dam would be, with less difficulty, accomplished in one on this new principle. The shutters, instead of being of the shape used in the model, might be made sufficiently deep, and grooved so as to be driven into the bed of the river to any required extent, after the clearing of the dam, and the excavation could be progressing foot by foot as the shutters were driven in.

If these dams were built on speculation, to let them out on hire, it would be necessary that there should be at least three, of different sizes, so as to supply the demand for such as would be suitable for rivers and foundations of different depths and breadths.

Your obedient Servant,
GEORGE P. PAYNE.

DESCRIPTION OF ENGRAVINGS.

Fig. 1. Shows the boats united, forming the Coffer Dam complete.

Fig. 2. Shows the interior of the Coffer Dam.

## IMMATERIAL CAPITAL.

NO. III.

THE value of land is estimated, first, by its quality; secondly, by its extent. One man, A, has a piece of ground; it is small, but fruitful; he is neither rich nor poor. Another man, B, has land, both small in extent, and sterile as a rock; he is a poor man. A third, C, has an estate, extensive and fertile as Paradise. We say immediately that C is a rich man. Each is entitled to all the productions of their respective allotments, and it would be esteemed a robbery and a brutality, were one B, on account of the illness and consequent inability of C to take his produce to market, to offer his services, dispose of the goods, and keep for his trouble 80 or 90, or 99 per cent.; yet with respect to immaterial capital and mental estate, this is constantly occurring, and no surprise is manifested at, and no indignation shown towards, the robber. A noble and majestic mind is continually subject to similar depredations. Its fruits are pilfered, because its possessor cannot surround it with a hedge. Its beauties are defaced, because he is a cripple, and

Digitized by Google

cannot arise to defend them. The value of his property is great. The towering trees, the beautiful shrubs, the delicious fruits, the brilliant flowers, and the sparkling gems that it produces, are without price, yet he is frequently compelled to barter them for subsistence.

The only true and proper standards for the determination of value, are, 1st, The uses to which the commodity to be valued is applicable; and, 2ndly, Its relative plenty or scarcity. If we apply these tests to the kind of capital in question, we shall find its value to be universal, and that our assertions respecting it are something more than a poetical rhapsody; that they are invested (however romantic they may appear), with the sober attributes and dignity of truth.

The task which I have undertaken of pointing out the uses to which immaterial capital is applicable, would be herculean and unenviable indeed, were it necessary to point to individual cases, and to establish the soundness of my position by the millions of examples which might be adduced. Let general principles, therefore, suffice. Let us consider closely, and examine minutely, and we shall perceive that but for this property and endowment of superior minds, the histories of every empire in the world, from that of the proud Nimrod, to that of the eternal city, could not possibly have existed. The narratives of various classes of mankind, would have born a striking resemblance to certain parts of De Foe's inimitable Crusoe. Alexander the Great would have been a remarkably tall savage, and Archimedes would have built a canoe of extraordinary dimensions; Julius Cæsar would have devoured more human beings than any other man, and Virgil would have chattered a war song in his praise, accompanied by the music of marrow-bones and cleavers. If, then, this capital, this progressive principle of our nature, has enobled and dignified man, if it has raised him so pre-eminently above the level of the brutes that perish. If this immortal mind has secured such brilliant results, and has been applied to such important uses; if, in fact, it is this that enriches and exalts a nation more than any other thing, surely it is the interest of mankind to protect and encourage its advances, to applaud and to honour its salient leaps; to break down every obstacle that impedes its majestic progress, and to protect it from that oppression which might weaken and destroy its power. It has been asserted (though I think that it is saying to much), that by means of this capital judiciously employed and unrestrained in its operations, labour would be unnecessary for man; but one thing is certain, viz. that by its instrumental ty, cramped and fettered as have hitherto been its exertions, power has been multiplied, happiness has been increased, and the whole human race has been signally blessed.

The knife, the plough, the saw, the lathe, and the steam engine, and, in fact, every other improvement upon the usages of savage life, may be considered as the medals of its history, and these have been preserved through every period of time. The master minds which have adorned the world, are the heroes that adorn its archives, and the mighty nations that have bowed beneath the universal sway of utility, are the conquests that it boasts.

BASILIUS.

## MECHANICS' LIBRARY.

*The benefits of General Knowledge, especially the Sciences of Mineralogy, Geology, Botany, and Entomology.* By the late ROWLAND DETROSIER.—Cleave.

THIS address was delivered at the opening of the Banksian Society of Manchester, which was established in January, 1829, for the purpose of promoting the study of the sciences above mentioned by the working classes. The address contains an interesting detail of many pleasing facts, and will do much, as we have no doubt it has already done much, towards promoting the study of them. Detrosier's eloquence and talent were never seen to greater advantage than when he was engaged in addressing the working classes on the necessity for their obtaining an acquaintance with moral and physical science; and the pamphlet before us is one of his most earnest appeals. It is full of eloquent truths, and every working man will do well to make himself acquainted with them. Speaking of the improved intellectual condition of the people at the present time, compared with former periods, Detrosier observes,

"The tricks and deceptions practised upon the weakness and credulity of mankind, in former ages, would now be attempted in vain with those who have been enlightened by the discoveries of modern times; for as our knowledge increases, we are not only enabled more effectually to secure a healthful and happy state of existence to ourselves, but also to guard against and protect imposition and craft, though the one might have been sanctified by age, and the other protected by the suspicious influence of a name. Who,

Digitized by Google

that has but paid a casual visit to the temple of science, does not smile with contempt at the unfounded prognostications of a weather-wise Moore, or feel the blush of honest indignation mantle over his face at the shameless want of principle which induces individuals, in the nineteenth century, to outrage public decency by exhibiting a catalogue of the members of the human body, in the order of time at which the planetary bodies are said to exert their influence upon them? Knowledge is the powerful lever by which man has raised himself above the level of the brute; and as the pages of the moralist and the historian amend the heart by informing the understanding, so the study of natural philosophy dignifies the character, by increasing our powers of usefulness to others. Nor are the details of natural philosophy less interesting than they are profitable and useful. Nature invites us, through the medium of a thousand beauties, to its study. The very stones on which we tread are replete with instruction to the contemplative, whilst the grass of the field, and the ephemeral being which is the cheerful recipient of life but for a day, contribute alike to our instruction and delight. And who is it that will presume to say, that the study of these subjects is necessarily confined to any particular class of society? Who so hardy as to declare that an increased individual knowledge of them would impart to it no moral benefits? How striking is the difference between the man of intellect and the mere sensualist in the appropriation of their leisure hours! The one increases his means of happiness, and preserves his health, whilst the other wastes his property and hastens his death. One finds his greatest pleasure "in holding sweet converse with the mighty dead;" in tracing over the living sentiments of those great teachers whose bodies have long since mingled with the dust; or in learning, with avidity and delight, the imposing discoveries of modern times. The other passes over the surface of this beautiful world with eyes open indeed, but seeing not, incapable of performing any higher office than that of a mere caterer for the body's wants. This difference of taste, which principally, nay, I may say solely, arises from the difference in education, gives birth to the distinguishing opposites in conduct, of virtue and vice in various degrees. Man, in a state of ignorance, becomes the dupe of artifice, the victim of error, and is destroyed by the operation of those very causes which would, under a proper discipline, become the principal aids to his happiness. His passions and his appetites, which in a state of ignorance are the tempests that hurry his deluded bark to destruction, when properly directed, become the means of good and great actions, as they are the true and only sources of rational pleasures. They are the elements of life; to destroy which is out of our power,—to attempt it criminal. It is perfectly within our power, however, to subject them to the dictates of knowledge and experience, and thus engage them in the cause of usefulness and virtue. They have long since been engaged in the cause of vice. The ambition of a dog-fighter or a pugilist differs only in its object from that which governed a Cæsar, or a Buonaparte. It is precisely the same in its nature; and had it been directed to other and more worthy objects, might have produced a Lock, a Milton, or a Franklin. Strong natural powers are the sources of strong natural passions, which seek, as naturally as the eagle seeks the sky, or rests him on the towering and lofty rock, objects calculated to call forth the exertion of their energies, and on which they can rest with self-satisfaction. These are the strong and restless spirits of the age, that be active in vice or virtue; that they have not been engaged in the cause of the latter is the fault of circumstances rather than of themselves. Were the thinking powers of the poor man properly cultivated in youth, were his energies properly directed, and his pride engaged in the love of that distinction which arises from the possession of knowledge, how different would be the conduct of thousands who are lost to a sense of their degraded situation, because they have never been elevated above it.

*To the Editor of the* PENNY MECHANIC.

SIR,—Allow me, through the medium of your very useful publication, the PENNY MECHANIC, to ask your readers to imagine themselves seated quietly to witness the approach of the devil, (nay, don't start), with flames of fire issuing from his nostrils, eyes, and mouth, accompanied by all the fiends, furies, and imps of hell in his train;—let them suppose his approach from the depths of hell, through a subterranean cavern flaming with fire;—let them also imagine his first approach to be accompanied with a thrumbing noise, gradually increasing to a thundering rattle;—let them imagine, likewise, his entering open space from the depths of a horrible flaming

Digitized by Google

cavern, with his jaws wide open to devour and destroy the whole of the creation, the noise increasing; then, again, let them suppose him and his train stopping to vent his rage and fury on a particular part of the world, while a part of his train move off to commence other ravages;—I say, let your readers imagine all this, and they will have a very faint idea of the horrible and terrific appearance of the approach of the steam engine and train issuing from the tunnel beyond Chalk Farm, at about a quarter past eight o'clock at night, and its arrival at the station near the canal. I saw the arrival last night, and must say it was the most grand, awful, horrible, and terrific sight I ever saw.

I am, Sir, yours respectfully,
Aug. 10, 1837. W. H.

P.S. This extraordinary spectacle may be seen to advantage about two hundred yards from the tunnel on the side next Chalk Farm, and close down to the boundary wall.

## BIOGRAPHICAL SKETCHES.

### ALEXANDER WILSON.

(*Continued from page 29.*)

At the close of the year 1805, he made an unsuccessful attempt to be appointed to take part in an exploratory expedition which the American government was then about to send to the valley of the Mississippi. He addressed his application on this occasion to President Jefferson stating to that functionary what he had done in the prosecution of his intended work on American ornithology, and representing the advantages which the being permitted to accompany the party would afford him in furthering his views. To this communication, from what cause is now unknown, he obtained no reply, and of course did not join the expedition. Soon after this more cheering prospects presented themselves to the enterprising ornithologist. A Mr Samuel F. Bradford, a publisher in Philidelphia, who was about to print an edition of Rees' Cyclopædia, engaged Wilson, on what the latter himself called liberal terms, to superintend the publication of that work. But this connection presented another inducement to Wilson, and one which had infinitely greater attractions for him than any which related to his own personal advantage. This was the prospect it afforded him of procuring a publisher for his work, and so far he was not disappointed. On his explaining the nature and object of his undertaking, Mr. Bradford readily consented to be his publisher; and in September 1808 the first volume of "American Ornithology" appeared, one of the most splendid books by far which had then emanated from the American press; but unfortunately the price was, though necessarily, much too high for a country comparatively in its infancy, and which had not then had time to turn its attention to the arts or sciences, or to acquire a sufficient taste for them to encourage such an expensive appeal on their behalf. The price of the work, when completed, was to be 120 dollars. It is not therefore at all surprising to find, that, even a considerable time after its publication, its ingenious, but in this respect certainly injudicious author, could only boast of forty-one names on his list of subscribers. This number, however, he afterwards increased to two hundred and fifty, by travelling through the country, and visiting the different towns in quest of patrons; but these, he himself says, were obtained "at a price worth more than five times the amount;" and they no doubt were so, if wounded feelings, fatigue of body and mind, and all the humiliations to which such a mission must of necessity have frequently subjected him, be taken into the account. From this tour he returned to New York in March 1809.

Two hundred copies only of the first volume of the Ornithology had been printed, but it was now thought advisable to throw of three hundred more, which was accordingly done; and in the mean time, Wilson assiduously employed himself in preparing the second volume for the press, yet although he had neither benefited to the extent of a single dollar by the publication of his work, nor was likely to do so. The second volume appeared in 1810; and immediately after its appearance, the author set out on another tour in quest of support and patronage. This time he penetrated into the western parts of the states, or valley of the Ohio and Mississippi. At Pittsburg, he succeeded beyond his expectations in getting subscribers; and after ascertaining that the roads were such as so render a land journey impossible, he bought a small boat, which he named the *Ornithologist*, intending to proceed in it down the Ohio to Cincinnati, a distance of more than five hundred miles. Some advised him not to undertake the journey alone; but he made up his mind, and only waited, exploring the woods in the interval, till the ice had left the stream.

*(To be continued.)*

Digitized by Google

# THE CHEMIST.

## LAWS OF CHEMICAL COMBINATION.

### ATOMIC THEORY.

ALTHOUGH, as we have shown in our former paper, the great variety of animal, vegetable, and mineral productions on the earth are all composed of a few simple elements, a list of which will be found in our 42nd No., yet it is an important law of chemical combination, "that these bodies can combine together only in a few proportions." Thus oxygen will only form one compound with zinc, and two with hydrogen. Other bodies unite in three, four, five, and even six proportions. The latter is the greatest number known, though there is nothing in the nature of things to prevent one substance forming more numerous compounds. This doctrine was strongly opposed some years back by the celebrated chemist Berthollet. He maintained, "that within certain limits, bodies had a tendency to unite in all proportions; that combination was never definite and invariable, except when rendered so by the operation of accidental extraneous causes. These influencing circumstances are cohesion, crystallization, insolubility, elasticity, and the like. Thus, according to Berthollet, sulphate of barytes is composed of 40 parts of sulphuric acid and 78 of baryta, not because those substances are disposed to unite in that ratio, rather than in any other, but because the compound so constituted has a greater cohesive power. These opinions, which, if true, would shake the whole science of chemistry to its foundation, were founded on observation and experiment, backed by all the ingenuity of that highly-gifted philosopher. They were ably and successfully combated by Prout, in several papers published in the Journal de Physique, wherein is proved, that the metals were disposed to combine with oxygen, and with sulphur, only in one or two proportions, which were definite and invariable. There are some phenomena which may be regarded as exceptions to the law now stated; those instances, namely, in which combination appears to take place, within certain limits, in every proportion. The most common examples of the kind, are the solution of a salt in water; the combinations of silica with the alkalies in the manufacture of glass; and the union of the metals with one another by fusion. It is exceedingly questionable, however, whether these exceptions are not rather apparent than real; for it is probable that the apparent variety of the proportion arises from the mixture of the compounds with each other.

The last important law we shall notice, has not been discovered many years, but it has already given an extraordinary degree of exactness to the science, particularly in analysis, and promises to do much towards explaining many phenomena, of the cause of which we are at present in ignorance. It was first noticed by Dr. Dalton, that a certain quantity by weight of one simple substance, will only combine with a certain quantity by weight of another, and from this he was led to conclude, that the atoms of different substances were by different weights. Pursuing his inquiries, he found, that if he affixed an imaginary weight to the different atoms, that when they combined in one or more proportions, the quantity combining must be a multiple of some simple whole number. This will be better understood from the following table, wherein an atom of hydrogen is supposed to be 1, oxygen 8, and nitrogen 14, the real atomic numbers, as may be seen by referring to page 15, Vol. 2.

| | | | | |
|---|---|---|---|---|
| Water is composed of | Hydrogen | 1 | Oxygen | 8 |
| Deutoxide of hydrogen | do. | 1 | do. | 16 |
| Hyposulphurous acid... | Sulphur | 16 | do. | 8 |
| Sulphurous acid..... | do. | 16 | do. | 16 |
| Sulphuric acid..... | do | 16 | do. | 24 |
| Nitrous oxide ..... | Nitrogen | 14 | do. | 8 |
| Nitric oxide ..... | do. | 14 | do. | 16 |
| Hyponitrous acid ..... | do. | 14 | do. | 24 |
| Nitrous acid..... | do. | 14 | do. | 32 |
| Nitric acid ..... | do. | 14 | do. | 40 |

It will be perceived, that in all these compounds, the numbers denoting the oxygen, which is attached to a given weight of the same base, bear a very simple ratio to one another. The deutoxyde of hydrogen contains just twice as much oxygen as the water does. The oxygen in the compounds of nitrogen and oxygen, is in the ratio of 1, 2, 3, 4, and 5. We must, therefore, regard it as a general law, the enunciation of which is as follows:—When one body A unites with another body B, in two or more proportions, the quantities of B are multiples by a simple whole number of the smallest quantity of B, with which A can unite.* It is often called the law of multiples, or of combination in multiple proportion, and is the groundwork of what is termed the atomic theory.

Having ascertained the facts we have just described, Dr. Dalton, in a series of very beautiful experiments, proceeded to determine the weights of the atoms of different simple substances. Hydrogen be-

* Dr. Turner.

Digitized by Google

ing the lightest, he called its weight 1, oxygen being eight times heavier, its atomic number was 8; and so on, with the different simple substances, a list of which, with their atomic numbers, will be found at page 15.

In a future Number we will describe the manner in which a person who understands the atomic theory, can easily determine the composition of any compound body; and point out how some apparent exceptions to the theory are explained.

*To Engrave Figures on Glass.*—Cover one side of a flat piece of glass, after having made it perfectly clean, with bees' wax, and trace figures upon it with a needle, taking care that every stroke cuts completely through the wax. Next make a border of wax all round the glass, to prevent any liquid when poured on from running off. Now take some finely powdered fluate of lime (flour spar), strew it evenly over the glass plate (upon the side), and then gently pour upon it, so as not to displace the powder, as much sulphuric acid, diluted with thrice its weight of water as is sufficient to cover the powdered fluor spar. Let every thing remain in this state for three hours, then remove the mixture, and clean the glass by washing it with oil of turpentine. The figures which were traced through the wax will be found engraved on the glass, while the parts which the wax covered will be uncorroded. Rationale: The fluate of lime is decomposed by the sulphuric acid, and sulphate of lime is formed. The fluoric acid disengaged in the gaseous state, combines with the water that diluted the sulphuric acid, and forms liquid fluoric acid by which the glass is corroded.

J. R. WATTS, M.D.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Can you, or any of your Correspondents, inform me, through the medium of your valuable Magazine, how those *alum baskets*, that are used as chimney ornaments, are made. An answer in an early number will oblige

A CONSTANT READER.

SIR,—I shall feel obliged if I can be informed how the nitro-muriate of gold is made, or where I can buy it; also the most approved way of polishing, glazing, and blueing of light steel.

Your obedient servant, W. W.

### ANSWERS TO QUERIES.

*Varnish for Coloured Drawings*—We think the following will answer "Notiveb's" purpose:—Canada balsam, one ounce; oil of turpentine, two ounces; size the drawings first with a jelly of isinglass, and when dry, apply the varnish, which will make them resemble oil paintings.

J. R. W.

*Exhibition of Iodine.*—Put two or three grains of this substance in a small glass tube, which is to be hermetically sealed; if it is then gently heated by holding it over a lamp, the iodine is converted into a beautiful violet-coloured vapour.

J. R. W.

*To the Editor of the Penny Mechanic.*

SIR,—The *London Electrical Society*, to which your Correspondent in No. 42 alludes, held their last meeting for the season on the 12th of August last, when they adjourned until the 7th of October next, when the regular weekly meetings will be resumed. Although the Society has only been established about three months, the meetings have been so numerously attended, that the Committee are now making arrangements for greater accommodation, which, when announced to the Society, I will take an early opportunity of making you acquainted with. The meetings have hitherto been held at the Laboratory of Science, Lowther Arcade.

I am, Sir, your obedient servant,

D * .

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Sept. 6, Quarterly General Meeting; Friday, Sept. 8, John Hemming, esq., on Chemistry, at half-past eight o'clock.

*Aldersgate Street Literary and Scientific Institution.*—Wednesday, Sept, 6, Charles Cowden Clarke, esq., on Early English Poetry, at eight o'clock.

*Eastern Athenæum*, Stepney-square.—Wednesday, Sept. 6, Quarterly General Meeting, at eight o'clock.

*Saint Pancras Institution*, Colosseum House, New-road.—Tuesday, Sept. 5, Mr. Jones, on the Physical Constitution of Man, at half-past eight o'clock.

*Westminster Mechanics' Institution*, 5, Little Smith street.—Thursday, Sept, 7, Dr. Frith, on the Anatomy and Physiology of the Eye, at half-past eight o'clock.

*Tower Street Mutual Instruction Society.*—Monday, Aug. 18, Mr. Sherman, an Essay on the Beauties of Dramatic Authors, at half-past 8 o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, Sept. 5, Mr. Gregory, on Botany, at half-past eight o'clock.

## TO CORRESPONDENTS.

*Correspondents are in future requested to direct their Letters* "To the Editor, AT THE PRINTER'S, Holloway Press, Islington." *All communications to be Post Paid.*

*This Number is accompanied by the Title and Index, every purchaser of which is entitled to a splendid Frontispiece, &c., to Vol. I.*

"Everpoint's" *parallels are ingeniously contrived; his letter shall appear soon.*

"Wallington's" *drawing is in the engraver's hands. We will endeavour to find room for* "Georgius," *if possible, next week.*

"R O.****D." *We have had so many communications on* "*Cheap Electrical Apparatus*," *that we cannot find room for all. As our Correspondent's plan seems both simple and cheap, we will endeavour to find room for it shortly.*

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

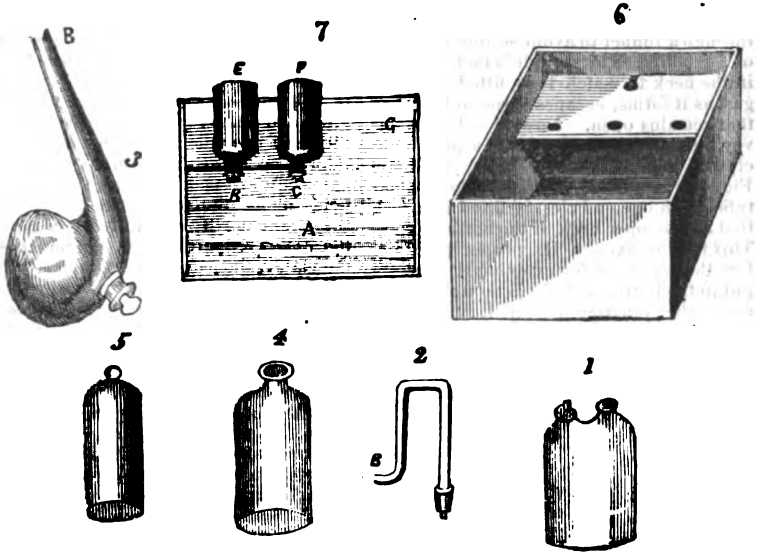
Digitized by Google

# THE PENNY MECHANIC,

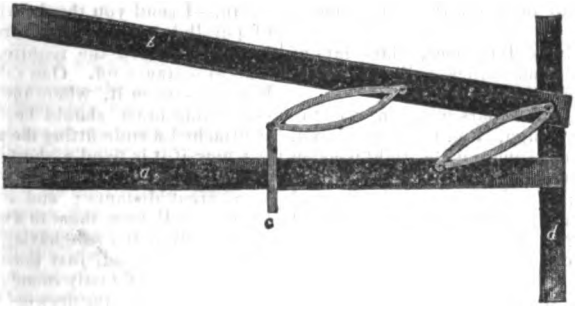
## AND THE CHEMIST.

No. XLVI.] SATURDAY, SEPTEMBER 9, 1837. [Vol. II.

### APPARATUS FOR MAKING AND COLLECTING GASES.




### PARALLEL RULES, FOR DRAWING PERSPECTIVE LINES.




Vol. II.—No. XLVI. Holloway Press: D. A. Doudney.

Digitized by Google

## APPARATUS FOR MAKING AND COLLECTING GASES.

*To the Editor of the Penny Mechanic.*

*Fig.* 1 represents a glass bottle with two necks, one of which has a glass stopple fitted to it by grinding. This utensil is employed when a gas is to be obtained without the aid of heat. The materials which are to afford the gas are put into the bottle. The solid part being broken into small pieces to facilitate chemical action, and the liquid being poured through a funnel to avoid soiling the neck of the bottle. The stopple is then inserted in the neck to which it is fitted, and the gas, as it forms, escapes through the neck that remains open. Now in order to convey the gas thus evolved into a proper recipient, the instrument represented by Fig. 2 is employed. This is a bent glass tube, with one end closely fitted in a cork that fits the open neck of the bottle, Fig. 1. This tube is fixed in its proper place before the materials for evolving the gas are put in the bottle, and if it is thought necessary, the junction is luted. The gas, therefore, when formed, escapes from the open end B, of this tube.

For procuring the gases that are producible by the aid of heat, the retort, Fig. 3, is generally employed. The materials are inserted through the tubulare (or opening at the top of the body of the retort), which is then closed by a glass stopple, and the round part of the retort (which must be very thin, in order that it may bear the application of heat) is then placed in one of the rings of a lamp-furnace over a lamp giving a gentle heat. The materials will then give out the gas, which of course escapes through the neck B of the retort. In many cases a Florence flask, with a cork perforated by a bent glass tube, or even by a thin pipe, will serve instead of a retort, and is much cheaper.

For receiving the gases, glass jars of various sizes and shapes, as Figs. 4 and 5, are indispensable.

To contain these jars when in use, the pneumatic trough, Fig. 6, is required. This is a strong square water-tight wooden box, the internal dimensions of which are as follows':—depth 8 inches, length and breadth each 16 inches; a shelf 16 inches long, and 8 inches wide, having four holes cut in it, as is represented in the figure, is fixed in one side of the interior of the trough at such a height, as to leave a space of two inches and a half between its top and the top of the box Fig. 7, is a section of the box; A is the body or open part of the trough; B is the shelf; E and F are two glass jars inverted over two holes E and D, made in the shelf. When the pneumatic trough is used, water must be poured into it, till it rises about one inch above the upper surface of the shelf, to the point marked G in Fig. 7. When the glass jars E and F, Fig 7, or any other vessels open only at one end, are plunged under water and inverted after they are filled, they will remain full, notwithstanding their being raised out of the water, provided their mouths be kept immersed; for in this case the water in the jar is sustained by the pressure of the atmosphere in the same manner as mercury in a barometer. The jars are to be thus filled and placed mouths downwards upon the shelf over the holes, and the necks of retorts, or the ends of tubes from which gases are evolved, are directed below the holes under the jars; then the gases, as they issue forth, rise in bubbles through the holes, enter the jars, driving thence the water, and occupying its place. When, therefore, the jars are thus emptied of water, they are filled with gas. When it is necessary, in order to make room on the shelf of the trough, to move some of the filled jars off it, proceed thus:—if the jar to be removed has a wide mouth, it must be gently slid off the shelf into a flat dish filled with water; but if the jar has a narrow mouth, all that is necessary is to insert in its neck, while it remains under water, a ground glass stopple, or a good cork. Some gasses, such as oxygen, may be kept in common wine bottles for several months, secured merely by corks.

J. R. Watts, M.D.

## PARALLEL RULES, FOR DRAWING PERSPECTIVE LINES.

*To the Editor of the* Penny Mechanic.

Sir,—I send you the drawing of a pair of parallels with which I draw perspective lines, where the required points are a great distance off. One side of the rule has a groove in it, where the rivet of the connecting brace should be; to the brace is attached a slide fitting the groove tightly; now if it is fixed a short distance out, it will draw lines converging to a centre at a great distance; and if fixed at a greater, will draw them to a nearer point. At the end of the rule having the groove, is riveted a head, just loose enough to allow it to move easily round; this is kept down the edge of the drawing board, as is a T square; the head being moveable, allows the lower rule to be laid to any line; and then, by moving the upper one

Digitized by Google

to the place wanted to draw the next, it will draw it perspectively; the head having the effect of keeping the rules always the same distance from the centre. Stops must be placed to prevent the brace nearest the end from passing right angles, when the rules are extended open, and the other descending more than at right angles with the slide.

## WATER POWER.

The important discovery of a new application of water power, which is likely to be attended with the most important consequences, has been lately made by a tradesman in this town. Like all truly valuable discoveries, it is distinguished alike for simplicity and efficiency. It consists of a cylinder and a piston similar to those employed in a steam-engine. To the cylinder there are two entrance and two discharge pipes, one of each on either side of the stuffing-box of the piston. The same turn of the cock that limits the water into the one part of the cylinder opens the discharge pipe in the other, and thus a vacuum is formed. To work this, advantage is taken of the pressure of Shaw's Water, the height of the reservoir of which gives it a force of 60lb. to the inch in the lower parts of the town. A short time ago we witnessed an experiment with a cylinder two inches in diameter, worked with a jet of water somewhat less than a quarter of an inch in diameter, and the piston, although loaded with 1½ cwt., rose and fell six times in the minute. In this case the entrance and discharge pipes were equal in size, and the cylinder was placed in a vertical position. Since then the discoverer has had another model made with the cylinder laid horizontally, and with the discharge pipes nearly three times as large as the entrance ones, and by this means the motion was increased to 26 double strokes in the minute.—*Greenock Advertiser.*

## INJURIOUS OCCUPATIONS.

In our last volume the interesting question, "Whether any trades are so injurious to the health of those employed in them that they ought to be discontinued?" was discussed in two articles by an American writer. In addition to the list of unhealthy trades there given, we subjoin the following account of a very distressing evil that afflicts one class of workmen, and for which at present there is no effectual remedy. The ingenuity of man can never be employed in a better way than in devising means for removing the sufferings of his fellow creatures; and we hope the following statement may be productive of some good, by drawing the attention of ingenious men to the subject.

The knife-grinders of Sheffield are exposed to great danger from the breaking of the stones on which the knives are ground, but they have to do with a more insidious and not less fatal enemy, in the continual inhalation of minute particles of dust and ferruginous matter evolved from the stones, more especially during the process of what is called dry-grinding. The fork and needle grinders, therefore, who use no water upon their stones, and whose faces are constantly enveloped in this deleterious atmosphere, are most commonly the victims of this evil. The pernicious effects of the contact here alluded to manifest themselves in a complaint known as "the grinders' asthma," the occurrence of which is so certain, and the progress so unrelenting, that in a body of men consisting of several thousands in a single town, very few of them arrive at the age of forty-five! Indeed, among the fork-grinders, it is very rare to meet with an individual thirty-six years old, especially since the grinding has been so generally transferred from the water to the steam wheels. In the former of these, the men worked in large lofty rooms, which did not contain more than six or eight stones, were open at the roof, often without windows, and generally with the large cog-wheel in the inside; thus, such a complete circulation of the air was effected, that the small quantity of dust raised from these few stones was soon carried away. Moreover, for several months during each summer they could not work more than four or five hours a day, owing to a scarcity of water. With the steam engine a very important change has been introduced: the grinder now works in a small, low, glazed room, where there are ten or twelve stones, and the doors and windows kept almost constantly shut; hence, while a greater quantity of dust is evolved from so many stones, there is a proportionately less circulation of air to carry it away. Nor does the perpetual operation of the steam-wheel admit any of those seasons of relaxation for the recovery of health which occurred under the old system. To diminish or disarm this dreadful evil, various plans have been proposed; such as, that the grinder should wear about his neck a suit of magnets; these, although they collected a sufficiency of the metallic particles to exhibit the danger in all its hideousness, did not affect the stone-dust. To meet this remaining evil, a gauze cover for the mouth was added; the inconvenience, however, of these schemes, to say

Digitized by Google

nothing of their inefficiency, formed a sufficient obstacle against their general adoption. It must be added, however, that much praise is due to Mr. J. H. Abraham, an intelligent Sheffield gentleman, for the numerous magnetical experiments which he undertook in order to bring to perfection this method, and which certainly drew the attention of the public and scientific bodies in a particular manner. The Society of Arts awarded to Mr. Abraham a medal for his investigations on this subject. The most successful apparatus for abating this danger has been invented by a person of the name of Elliott, whose ingenuity has likewise, very properly, been rewarded by the gold Vulcan medal of the Society of Arts. Mr. Elliott's contrivance consists simply of a long box or wooden chimney, placed opposite to, and partially covering the stone in front, while the other extremity is carried through an aperture in the wall: in this arrangement it is found that such a current of air is excited by the mere revolution of the stone as to carry the dust evolved therefrom through this funnel, whence it may sometimes be seen issuing at the outside of the building. It might naturally be thought, as human life is generally so highly prized, that no inconvenience would be thought too great to be submitted to when its preservation and protraction are the reward. But although these grinders have certain disease and premature death before them, yet, as these effects are not instant and obvious in their approach, not only are the troublesome wire masks and magnetical collars discarded, but the more simple and less inconvonient contrivance above described too often lost sight of! Persons employed in fire-gilding, and others who use mercury are, it has been observed, compelled by the intolerable evil of sore mouths, &c., to take the necessary precautions against the effect of noxious fumes; but the grinders, stimulated by no such immediate intimations of an attack on the constitution hardly less fatal, seem to set remote consequences at defiance; as if they considered that, since the sum of life must be discounted so largely, it matters but little whether the amount be paid by instalments, or altogether at the last.—

*To the Editor of the* PENNY MECHANIC.

SIR,—I beg to call your attention to the following lines. I some time ago wrote you a letter upon Perpetual Motion, but by some mistake a wrong one was sent. I write this to vindicate my character. Your correspondent, "Jack's Brother," is quite mistaken from beginning to end; but if a person reads it and takes it in the intended sense, he will find what a bungle "Jack's Brother" makes of it, and in the last he calls me an entranced and visionary seer. Now, let me ask, is this proper language? The reason I did not write before is, that I have been occupied on urgent business; nor should I have written at all had not some friends advised me to do so. Hoping that his future letters will be couched in milder terms, I shall not enter into it further, but remain, yours truly,

Z. Wiee.

## BIOGRAPHICAL SKETCHES.

### ALEXANDER WILSON.

(*Concluded from page* 38.)

The time arrived for his departure on this inland voyage. His provision consisted of some biscuit and cheese, and a bottle of cordial, given him by a gentleman in Pittsburg; one end of the boat was occupied by his trunk, great coat, and gun; and he had a small tin vessel, with which to bale his boat, and to drink the water of the Ohio. Thus equipped, he launched into the stream. The weather was calm, and the river like a mirror, except where fragments of ice were floating down. His heart expanded with delight at the novelty and wildness of the scene. The songs of the red-bird in the deep forests, the smoke of the various sugar-camps rising gently along the mountains, and the little log-huts, which here and there opened from the woods, gave an appearance of life to a landscape which would otherwise have been lonely and still. He could not consent to the slow motion of the river, which flowed two miles and a half an hour; he therefore stripped himself for the oar, and added three miles and a half to his speed. Our traveller's lodgings by night were less tolerable than his voyage, as he went down the desolate stream. The first night was passed in a log-cabin, fifty-two miles below Pittsburg, where he slept on a heap of straw.

Having reached Cincinnati, he there got a few subscribers for his work, and then proceeded to Louisville, where he sold his boat. He next walked a distance of seventy-two miles to Lexington, whence he travelled to Nashville, exploring on his journey some of the remarkable caverns of Kentucky. He had thoughts of extending his tour to St Louis; but after considering it would detain him a

Digitized by Google

month, and add four hundred miles to his journey, without perhaps adding a single subscriber to his list, he gave up the plan, and prepared for a passage through the wilderness towards New Orleans. He was strongly urged not to undertake it, and a thousand alarming representations of hardship and danger were set before him; but, as usual, he gave fears to the winds, and quietly made preparations for the way. He set out on the 4th of May, on horseback, with a pistol in each pocket, and a fowling-piece belted across his shoulder. During this adventurous journey he suffered severely from the heat of the sun, and all the changes of the weather. His exposure by night and by day brought on an illness, which he with difficulty surmounted. He had occasion to travel among the Indians, who, it seems, treated him with great kindness; and though dreadfully worn out with fatigue, he enjoyed the journey very much. He reached New Orleans on the 6th of June, and shortly embarked in a vessel for New York, and from thence he proceeded to Philadelphia, where he arrived on the 2d of August 1810.

While sitting one day with a friend, he caught a glimpse from the window of a rare bird, for which he had long been vainly looking out. The instant he saw it, he seized his gun, rushed out of the house in pursuit of it, and after an arduous chase, during which he swam across a river, succeeded in killing it; but he succeeded at the expense of his life. He caught a violent cold; this was followed by dysentery; which carried him off after an illness of ten days' continuance. He died on the morning of the 23d August 1813, in the forty-seventh year of his age, and was buried in the cemetery of the Swedish church, in Southwark, Philadelphia. A plain marble monument, with an inscription, intimating his age, the place and date of his birth, and of his death, marks the place of his sepulture.

Wilson had completed the seventh volume of his Ornithology before he died, and was engaged, when seized with his last illness, in collecting materials for the eighth. At this he laboured with an assiduity and unintermitting industry which called forth the remonstrances of his friends. His reply, while it seems to indicate a presentiment of his premature fate, is at the same time characteristic of his extraordinary enthusiasm and diligence, "Life is short," he would say on these occasions, "and nothing can be done without exertion." Nor is a wish, which he repeatedly expressed to a friend some time before his death, less characteristic of his amiable nature and deep admiration of the works of his creator. This wish was, that he might be buried *where the birds might sing over his grave.*—*Chambers' Educational Course.*

## COAL.

*To the Editor of the* PENNY MECHANIC.

SIR,—I take the liberty of sending the following extract which may most probably be useful to some of your numerous correspondents:—

"Vegetable coal is commonly distinguished by the name of charcoal. The word coal is almost exclusively applied to denote mineral or pit coal; of this there are many varieties, respecting which much information may be derived from the Mineralogy of Kirwan. The Legislature, however, distinguish only two kinds relating to the duties payable thereon; namely, culm and caking coal; the former does not consolidate by a kind of fusion into large masses when heated as the latter does, and cannot therefore be applied to such a variety of uses.

Pit coal is usualy found in strata in the earth, almost always in mountains of grit. It appears to be a general opinion that this substance owes its origin to the decomposition of vegetable bodies; and indeed, when we attend to the inflammable substances found in the earth, or in the mineral kingdom, we may perceive that very few, and most probably none of them, can be truly said to belong to it, but have been elaborated in the bodies of animals or vegetables. From the turf that is pared from the surface of the earth and owes its inflammability to the roots of vegetables which are mixed with it, we may descend to the peat, or black earth of the moors, in many specimens of which vegetable remains are still perceptible, though in most they appear to have lost every appearance of their organic texture; their oily and inflammable nature only remaining and thence the transition to pit coal is easy; for if we reflect on the vast revolutions which the earth has certainly undergone through a long course of ages, by means of which its surface has been broken, displaced, and inverted, from the actions of floods, earthquakes, and the great convulsions of nature, caused by volcanic eruptions, it will be no improbable inference that the thin, though extensive strata of pit coal, as well as the exudations of naptha and their modifications, have all arisen from the burying of extensive woody tracks of the surface,

Digitized by Google

such as are common in all uncultivated countries; and this probability will be reduced to a certainty when we advert to the naturality of pit coal, which is met with in all the various states of transformation. Whole trees are converted into pit coal in such quantities together as to exhibit entire forests, in which the roots, trunks, branches, bark, and even species are discernible. Coal pits and slate quarries exhibit innumerable marks of impression of leaves and other indications of their vegetable origin, and the analysis of this combustible substance tends still farther to confirm this truth. On the other hand, if we attend to such inference as chemical theory might point out from the facts around us, we shall see how small the probability is that the mineral kingdom should, after a certain limited time, contain inflammable bodies if they were not occasionally thrown into it in consequence of the operations carried within organized substances; for all inflammable bodies if the tending to decompose the oxygen of the atmosphere would, in process of time, reverse to the class of inflammable bodies, particularly of the vegetable kind, did not they tend to disengage the oxygen again and render bodies combustible which were not so when they became parts of those substances."

Yours truly,

Z. Wigo.

## MISCELLANIES.

*Steam and Hand Looms.*—The blessings which physico-mechanical science has bestowed on society, and the means it has still in store for ameliorating the lot of mankind, have been too little dwelt upon; while, on the other hand, it has been accused of lending itself to the rich capitalist as an instrument for harassing the poor, and of exacting from the operative an accelerated rate of work. It has been said, for example, that the steam engine now drives the power looms with such velocity as to urge on their attendant weavers at the same rapid pace; but that the handweaver, not being subjected to this restless agent. can throw his shuttle and move his treddles at his convenience. There is, however, this differenc in the two cases, that in the factory, every member of the loom is so adjusted, that the driving force leaves the attendant nearly nothing at all to do, certainly no muscular fatigue to sustain, while it procures for him good, unfailing wages, besides a healthy workshop *gratis*: whereas the non-factory weaver, having every thing to execute by muscular exertion, finds the labour irksome, makes, in consequence, innumerable short pauses, separately of little account, but great when added together; he earns, therefore, proportionally low wages, while he loses his health by poor diet and the dampness of his hovel. —*Ure's Philosophy of Manufactures.*

[Dr. Ure's well known partiality for the factory System has induced him in the work above quoted from, greatly to underrate the evils, and, we think, exaggerate the advantages of the system. The healthy workshops were rather differently described by the witnesses before the Factory Commissioners, to what they are in the above extract.]

*Largest American and English Ships.*—The largest ship in the world, the *Pennsylvania*, lately launched in America, is 3000 tons burthen:—

| | Ft. | In. |
|---|---|---|
| Length between the perpendiculars | 210 | 0 |
| Length of keel for tonnage | 173 | 6 |
| Length from figure head to stern gallery | 247 | 6 |
| Extreme breadth | 58 | 1½ |

Brother Jonathan will see, that our *steam boats* are not altogether of the Liliputian tribe. There is one now building at Curling and Co.'s, Limehouse, which exceeds the *Pennsylvania* in length by six feet. She is to ply between England and America; to be named the *Victoria*, and will cost nearly 100,000l.:—

| | Ft. | In. |
|---|---|---|
| Extreme length | 253 | 0 |
| Length between the perpendiculars | 237 | 0 |
| Length of beam between the paddle-boxes | 40 | 0 |
| Depth from floor to under side of spar deck | 29 | 0 |

The engines are two of 250 horse power each, with 6 feet 4 inch cylinders and 7 feet stroke; her burthen 1800 tons. Her average speed 200 nautical miles per day; consumption of coals 30 tons. It is calculated she will make her voyage to New York in 18 days, and the homeward in 12, consuming 549 tons of coal out, and 360 home. She is expected to be ready in November. Alongside this ship other steamers look like wherries (she is so werry large—*Sam Weller*).

*Steam* versus *Camels.*—Steam-engines often travel at the rate of forty miles an hour; the camels of Pisa walk at the rate of about three miles an hour, and they travel about thirty miles a day: they are rarely put out of their long stride into a trot, and this pace appears painful to them.

Digitized by Google

# THE CHEMIST.

## TO PREPARE LAUGHING GAS.

Protoxide of nitrogen, nitrous oxide, or as it is more generally termed, laughing gas, is a compound that the young chemist generally desires to procure as soon as possible; and we are induced, therefore, to give the following description of its properties and of the method to be adopted for obtaiuing it in a state of purity, although he must not expect to do so without considerable trouble and, perhaps, disappointment. Nitrous oxide is a compound of the same elements as those which constitute the atmosphere; but in consequence of containing a greater quantity of oxygen its effects upon the human frame, when breathed for a short period, are very surprising. It is not a gas that can be breathed with impunity for any great length of time, yet it can be received into the lungs for a short period without injury. It is termed laughing gas because its general effect upon persons who respire it is to induce a very strong desire to give way to violent fits of laughter. It does not, however, produce this effect on every individual. Some are made exceedingly melancholy, and others have the phrenological organ of destructiveness so powerfully excited that they appear desirous of annihilating everything on which they can lay their hands. In general, however, the gas only excites the person who breathes it to laughter. It acts as a powerful stimulent for a time, but unlike other stimulents, it is not followed by lassitude or lowness of spirits, unless while under its influence the person is excited to great muscular exertion. Sir Humphrey Davy made a variety of experiments with this gas. He administered it to various persons, and indeed was the first to investigate its properties with any degree of accuracy. Previous to his time the gas was considered to be unfit for the purpose of respiration, "but Davy found that it could be breathed with safety; and in his further experiments on it discovered the singular effects it produces. After a few inspirations of it have been made it causes a sense of lightness and expansion in the chest, and a pleasurable sensation begins to extend over the whole body; this increases and is accompanied with a desire to inhale the gas; respiration becomes therefore fuller, and is performed with more energy. Exhilaration is soon produced; and, if the respiration is continued sufficiently long, a crowd of indistinct ideas, often in very singular combinations, passes through the mind: there is an irresistable propensity to laughter and to muscular exertion, and violent exertions are made with alacrity and ease. These effects, after the inspiration has ceased, continue for four or five minutes, or sometimes longer; they gradually subside, and what is not the least singular, the state of the system returns almost immediately to its usual standard." We have frequently administered the gas to others and have breathed it ourselves, and when this is done in a proper manner we have never failed to observe or feel the effects above described. There is, however, some difficulty in administering the gas properly to a person who has never taken it before. It must be inclosed in a bladder fitted with a stopcock; and unless the person inhales it from the bladder without allowing any of the atmosphere to enter his lungs at the same time, the experiment will not succeed. The best way is, to close the nostrils with the left hand, and then forcing all the air possible from the lungs by a strong respiration, to place the stopcock in your mouth, and so breathe in and out of the bladder, at the same time keeping the nostrils quite closed. If this be done properly the gas is sure to produce its usual effects. When it is administered to a person, unless he has taken it previously and is aware of the manner in which it affects him, it is desirable to have some one near to prevent his doing any mischief in case he should feel so inclined. Self-command is in general entirely lost for a few minutes, although the individual is perfectly sensible all the time in what a ridiculous manner he is behaving. A bladder capable of holding five or six quarts of gas will be large enough, and it is advisable to test the gas by holding a light in some of it before it is taken, in order to prevent the danger of any one inhaling a gas destructive to life.

*To procure Nitrous Oxide.*—There are various methods of procuring this gas, but we think our readers will find it best to obtain it from nitrate of ammonia. This should be placed in a glass retort and exposed to the flame of a spirit lamp. It will soon melt, and shortly afterwards the gas will be evolved. It should be collected in a receiver and allowed to stand a short time over water in order to remove any impurities with which it may be contaminated. The nitrate of ammonia when melted, should only be kept simmering; for if the heat be increased too much it will cause a slight explosion, and nitric oxide and nitrogen gas will be produced. If it is wished to make a considerable

Digitized by Google

quantity of the gas it will be advisable, on the ground of cheapness, to prepare the nitrate of ammonia yourself. This may be done by pouring diluted nitric acid on carbonate of ammonia and evaporating the solution till the greater portion of the water is evaporated.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Can you, or some of your Readers, inform me of the best and lightest varnish for tissue paper balloons? Also, whether carburetted hydrogen gas will do to inflate the same? And will you be so kind as to let me know what is the best cement for sticking together the paper? An early answer to the above will much oblige

Your well wisher, W. S.

SIR,—Will you, or any one of your intelligent Readers have the goodness to inform me of the properties of lime, and how it is that it retains heat so long after being burnt? I am, Sir,

A SUBSCRIBER.

## ANSWERS TO QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—I beg to answer "W. W.'s" query. Nitro muriate of gold is made by taking one measure of nitric and two of muriatic acid, which will dissolve the gold. Steel (such as the watch-spring,) &c., is brought up to a face by the hammer; but that which cannot be brought up with the hammer is performed by a lathe. As for glazing, I know not what your Correspondent means. Polishing of large work is also performed by the lathe with emery and oil; the watch-spring is rubbed between two pieces of wood placed in an iron frame with screws to make the friction greator or less. Blueing is done by passing the work over a hot heater something less than red heat. I am, Sir,

A CONSTANT READER.

P. S. The spring is held in an iron frame something similar to a bow-saw with a screw at each end.

*Alum Baskets*—Make the shape of the basket of brass wire covered with worsted, which is to be hung in a pan so as not to touch any part. Then dissolve alum in the proportion of a pound to a quart of water by boiling and pour it boiling hot over the basket so as to cover it to the depth of two or three inches; let it stand undisturbed six or seven hours. If the crystals are not large enough the alum solution may be again boiled and poured over as before. They may be coloured blue with vitriol. J. R. W.

*Nitro-Muriate of Gold.*—No simple acid, however strong it may be, has the power of dissolving gold; but a compound made by mixing one part of nitric acid with two of muriatic does possess this property. On mixing the two acids heat is given out, an effervescence takes place, and the mixture acquires an orange colour A saturated solution of nitro-muriate of gold is of a deep-yellow colour, very caustic, and of an astringent metallic taste. It tinges the skin, and almost all animal and vegetable bodies, and even marble of a deep and indelible purple; it crystallizes, its beautiful golden colour being preserved; the crystals are very soluble in water, and still more so in ether.

J. R. W.

*Bronzing Liquor* is blue vitriol dissolved in water, used to bronze tea-urns, &c., the surface being previously well cleansed. J. W. R.

*Electrical Machine.*—SIR—My absence in the country at a place where I could not obtain your Periodical is the cause of my not having sooner answered "J. H. B.'s" query as to making the hole at the bottom of the bottle. The method I use is to hit it gently with a pointed steel instrument (a butcher's steel, for instance,) and make a small hole first, enlarging it to the proper size afterwards with a round file.

Your obedient servant, F. V. E.

*Printer's Composition for Rolls* is made simply of treacle and glue; the latter being allowed to soak in water for several hours previous to its being used. The quantity of treacle mixed varies according to the heat or coldness of the weather. It is then boiled up together, and becomes fit for use. For making rollers our Correspondent must purchase a cylinder, which will cost him four or five pounds.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*Aldersgate Street Literary and Scientific Institution.*—Wednesday, Sept. 13, Charles Cowden Clarke, esq., on Early English Poetry, at eight o'clock.

*Eastern Athenæum*, Stepney-square.—Wednesday, Sept. 13, F. Cooke, Esq., a Lecture on Science, at eight o'clock.

*Saint Pancras Institution*, Colosseum House, Newroad.—Tuesday, Sept. 12, Mr. Holdernesse, on Phrenology, illustrated by casts, &c., at half-past eight o'clock.

*Westminster Mechanics' Institution*, 5, Little Smith street.—Thursday, Sept. 14, Basil Montague, Esq., K.C., on Atmospheric Ghosts, at half-past eight o'clock.

*Islington Institution*, Thursday, Sept. 14, Mr. W. Burbidge, on Chemistry, at eight o'clock.

*Tower Street Mutual Instruction Society.*—Monday, Sept. 11, Mr. Chatterley, a Lecture on Natural History, at eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, Sept. 12, General Meeting, at half-past 8 o'clock.

## TO CORRESPONDENTS.

*Correspondents are in future requested to direct their Letters* "To the Editor, AT THE PRINTER'S, Holloway Press, Islington." *All communications to be Post Paid.*

"R. O. S." *His letter on the rain-gauge has been received. His definition of the "Quadrature of the Circle" is correct; but we have never heard of a premium being offered for its solution.*

*Thanks to* "J. R. Watt" *for his contribution.*

"H's" *letter shall be inserted. An article on Natural History now and then will be acceptable.*

*We have received a neat little work, entitled, "Queen Victoria's First Parliament" It does not exactly come within our sphere to review a book of this description; but at the same time we recommend it to the mechanics of this country as a book of reference. By this means they can at once note down the names of Members, and the places they represent, who may be favourable or hostile to measures brought before the Legislature affecting their interests.*

"Z. Wigo" *will see what he requests in our present Number.*

"J. F. S." *His letter on the "Power-loom" has been mislaid.—Received* "A Subscriber's" *letter.*

London: Printed at the Holloway Press, by D. A. DOUDNEY: published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

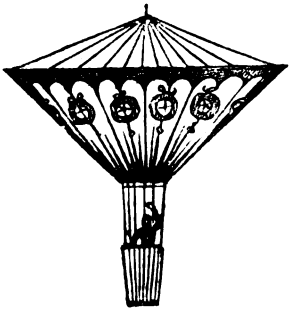
Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. XLVII.] SATURDAY, SEPTEMBER 16, 1837. [Vol. II.

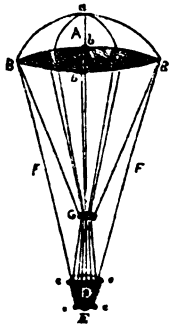

## PARACHUTES.

COCKING'S.

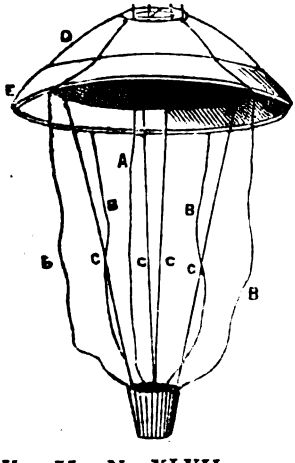


GARNERIN'S.

PARKE'S.

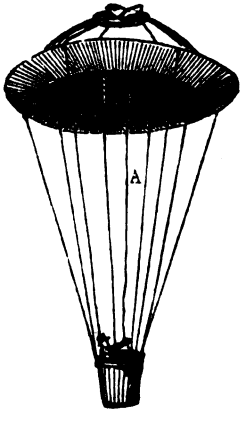



ASCENDING.




WILSON'S.

DESCENDING.







Holloway Press: D. A. Doudney.



Digitized by Google

Our present Number is illustrated with engravings of four parachutes. Should any of our readers, therefore, have a desire to visit the regions above, they can have a choice of conveyances to bring them down again safe to *terra firma*.

## WILSON'S PARACHUTE.

*To the Editor of the* PENNY MECHANIC.

SIR,—I send you a model of a parachute which is constructed on the principle of Messrs. Garnerin and Cocking, with the addition of a valve which opens outwards, which, by that means, can easily be regulated by the aeronaut. My motive for having a valve is to regulate the oscillation, which, by M. Garnerin's account, was greater at some times than others; and it being well known that Mr. Cocking's parachute could not oscillate is the reason I have adopted the cone. I have made models of the three parachutes and I find that Mr. Cocking's will not sustain very little more than half of M. Garnerin's; but the oscillation of the last getleman's is very great, while that of the former is scarcely perceptible, but it comes down with a greater velocity: the one of which I have sent you the model will sustain more weight, and is longer in the descent than M. Garnerin's, and the oscillation is not perceptible: the reason why the cone shifts is to facilitate the ascent. If you think it worthy of a place in your useful periodical you would oblige,

Yours respectfully,
M. B. WILSON.

EXPLANATION.—A, the valve-line; B B B B, the four cords attached to the rim of the shifting cone; C C C C, the four cords attached to the rim of the upper cone; D, the upper cone; E, the shifting cone.

[We certainly must say we form a very favourable opinion of the invention; the model sent to us is on rather too small a scale to decide of its capabilities, otherwise we should have tried it; but we would advise Mr. Wilson to apply to the proprietors of Vauxhall or the Surrey Zoological Gardens, who would, no doubt, construct one, which would most likely be of benefit to themselves, a source of gratification to the public, and the means of rewarding the ingenuity of the inventor.

We have much pleasure in informing Mr. Wilson and the Public, that we have had an interview with a gentleman who, for some time past, has made it his study to produce a parachute which would be found capable of allowing a safe descent from the greatest altitude. He has expressed his perfect confidence in the plan proposed by Mr. Wilson, with the addition of one or two minor alterations; and so satisfied is he that a steady, uniform, and safe descent may be effected by its means, that he has requested us to announce his willingness to make the experiment as soon as such a machine can be constructed, and an agreement entered into with the proprietors of a balloon capable of ascending with the parachute and its voyager, the weight of which he estimates will not much exceed 300 pounds, being 150 pounds less than that of the late unfortunate Mr. Cocking. Any communication, addressed to the Editor of this publication, will be promptly responded to by the gentleman here alluded to.]

## PARKE'S PARACHUTE.

*To the Editor of the* PENNY MECHANIC.

SIR,—I beg to send you herewith inclosed a drawing of the plan I propose for making parachutes. If you think it worthy of a small space in your valuable Magazine, perhaps you will be kind enough to insert it at your first convenience; and by doing so you will much oblige, Sir, your very obedient servant and subscriber,

Islington. CHARLES PARKE.

EXPLANATION.—A is the top of the parachute, composed of a frame made of a circular hoop of ash, also a piece of hoop one-third the size of the former bent in the shape of a bow *a*, and covered with fine silk. B B *b b* are four zinc clasps fixed to the hoop to fix the lines F F and the other two at *b b* to. *c c c c* are four wicker groves made to the basket D for the lines F F to move free in and keep them in their proper place: there are also four other grooves on the basket D for the lines from *b b*, which act in the same manner and are for the same purpose as *c c c c*. D a wicker basket, for the person who descends to place himself. E is a double wicker groove for the lines F F and those from *b b* to work in and placed in contrary directions, which act in the same manner as *c c c c*. F F are two safety lines for keeping the top A in its required position: for instance, suppose the parachute while descending loops at one side, no matter which, and as there are two lines F F and two *b b*, you have only to pull the opposite line, and the top top A will return to its required position, thus securing a safe descent. G is the knot which ties the lines which communicate the top A and the basket D together, which should be made of strong gut because of its elasticity.

Digitized by Google

## AIR PUMP.

*To the Editor of the* PENNY MECHANIC.

SIR,—In answer to your correspondent (*George*) in Number, 42, I beg to lay before him an *air puump* of the most simple form, and, at the same time, one that can be manufactured at a trifling expence, with which most of the experiments in pneumatics can be performed.

FIG. 1.

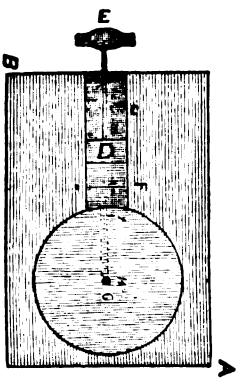



FIG. 2.

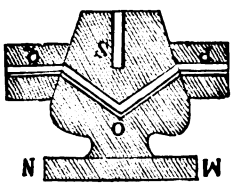



Fig. 1, A B is a board of hard wood, 18 inches long, 12 inches broad, and 1½ inch thick; C is a cylinder, or tube of brass or tin, 8 inches long, 1¼ inch diameter; D is a solid plunger, covered with leather to make it air tight; into this plunger must be screwed a strong wire with a handle at the end E, by which the plunger can be pulled up or down at pleasure. At F is a stop-cock, which is more clearly represented at Fig 2. The middle circumference P Q is divided into four equal parts; through one of the divisions is drilled a small hole to the centre of the cock S, and from the centre of the lower end R is drilled a passage to meet the former in S; also from two of the opposite divisions P Q, are drilled two passages to meet above the centre in O. Through the fixed part of the stop-cock must be drilled passages meeting the ends P Q of the passage P O Q. The end Q of the stop-cock is soldered into the end of the cylinder C. G is a circular plate of tin or brass, seven inches in diameter; H I is a half cylinder of tin, four inches long, and a quarter of an inch in diameter, soldered to the under side of the plate G; through the centre of the plate H is a hole drilled to meet this passage. To the end I of the half cylinder must be secured the immoveable part of the stop-cock, so as to connect the passage. The cylinder C must be neatly let into the board A B, so that the plate G may rest evenly upon its surface, and be properly secured. If the plate G is made of tin, it will not be accurately flat, in which case it will be necessary to cover it with leather soaked in water, except at the hole in the centre. When the receiver is adjusted, fix the handle of the stop-cock in the direction M N, draw up the piston D, and the air will rush out of the receiver through the passages into the cylinder C; then turn the head of stop-cock M N into the direction F O; push in the piston D, and the air will be forced out of the cylinder through the passage S R of the stop-cock. Again place the top of the cock in the direction M N, pull up the piston D, and more air will rush out into the cylinder C. which must be forced through the passage S R as before. This must be repeated till the air is exhausted in the receiver. To let air into the receiver, place the handle M N of the stop-cock in the direction O F, and air will rush into the receiver through the passage R S.

If the above is of any service to "George," and you deem it worthy of insertion in your valuable magazine, you will oblige

Your obedient, servant,

J.

## NATURAL HISTORY.

*To the Editor of the* PENNY MECHANIC.

SIR,—A stray number (for August 26) of your truly useful Miscellany having just fallen into my hands, I am induced to write a few words on the subject of preparing specimens of natural history, from a perusal of Dr. Watt's advice on that subject. He in common with many others of highly scientific attainments, has fallen into the error of supposing that the application of arsenical soap prevents the attacks of insects, and that it renders the specimens more durable. Experience, however, has demonstrated that, by such preparation, effects entirely opposite are

Digitized by Google

produced, and that corrosive sublimate is alone sufficient for all porposes. Although Mr. Swainson has advocated with much warmth the employment of arsenic, that substance, it is a fact well known, possesses properties so powerfully caustic as would be sufficient in a short time to completely corrode any animal object. The same has been proved by the experiments of Gould and Dunn; whilst the amiable author of the "Wanderings," Waterton, of Walton Hall, preserves his specimens solely by means of an alcoholic solution of corrosive sublimate; and they may, in truth, be reckoned inimitable. Dr. Lettsom's recipe was a most expensive preparation, particularly from the quantity of musk employed; but his directions for the preservation of insects are well worthy of attention, as are also those on plants. By the way, it is ludicrous to notice the statements continually ushered before the public respecting the preservation of fishes, each zoologist contending his plan to be exclusively his own original discovery, although they are all mere transcripts of the original by Linnæus, and differ not a whit in principle. It is as described by your Correspondent J. R. W.

In the collecting and preserving of insects there are several nice points to be attended to, which I propose at some future day to put to paper, if you think they would interest your readers. Can any of your Contributors inform me of the best method they have found for preserving coleopterous insects?

The study of natural history is, happily, now widely extending itself among all classes of society; and so replete is it with interesting details, that I consider I render a service to the world by contributing to their dissemination. I remain, with good wishes,

H.

## POWDER-BOAT ACCIDENTS.

*To the Editor of the* PENNY MECHANIC.

THE late dreadful explosion of the powder-boat off Blackwall, which caused a melancholy loss of human life, and the destruction of the Maltese brig, the Guiseppe, and which is supposed to have been ignited by some sparks from the funnel of a steamer, has led the public to inquire, "Are there no means by which the sparks may be prevented from issuing from the funnel?" A few days ago I was examining one of the engines on the Greenwich railway, and observed that the chimney had on the top a rather finely-worked wire cap, which is, I suppose, to prevent large sparks falling from it. If this be its use, why should it not be applied to steam-vessels? I have seen large sparks blown from the funnel of a steamer a considerable distance, and surely when such a dreadful accident as the one above referred to is liable to be caused by them, there cannot be the slightest objection to adopt this simple remedy. Even though no powder-boats were ever on the river, the sparks might perchance, in the crowded port of London, set fire to the rigging of one of the numerous vessels anchored there, the consequences of which are incalculable. The late accident is lamentable enough of itself to call for an immediate remedy ere another still more destructive of life and property should take place. I am, Sir, your's obliged,

J. F. S.

## IMMATERIAL CAPITAL.

NO. IV.

WE believe that there is nothing to which immaterial capital cannot be applied; we believe that its progress has no natural limits; and this, by the way, is one great proof of the immateriality of the soul. The relative scarcity or plenty of a commodity is another means of ascertaining its value; thus the diamond is valuable though almost useless, except for ornamental purposes, while iron is comparatively worthless, though intrinsically infinitely more valuable. In this light, then, as well as in its utility immaterial capital is of great value; for though an intellect characterised by mediocrity is by no means rare, yet a truly superior mind is also by no means common; and even supposing that it were more so, not to say by any means universally so, the methods in which it would employ itself would be found to be so various that no inconvenience, I apprehend, would supervene. Nature has bestowed on few minds uncommon power and energy. In the intellectual, also as in the physical world, the gems lay "few and far between" through the various strata, and their scarcity enhances their value in the one case as in the other; and although we are aware that many of the greatest minds are hidden in the shades of obscurity, yet we believe that if all were to be brought to face the light and in one bright phalanx to rival the sun in his brightness, that yet they would be as the small band of Leonidas compared with the rest of mankind who would outnumber them as the over-

Digitized by Google

whelming horde of Persians under Xerxes. A Waller, a Newton, or a Milton, or a Locke are common characters no every-day sights with mankind.

Nature struggled to produce a Homer, and when a thousand years had rolled away another heave of her gigantic bosom bestowed a Virgil on the world, then a pause of fifteen hundred mose revolving suns succeeded, and as if in despair to bring forth a third who should astonish mankind with such a daring originality as they, and in the beautiful words of the poet,

"To make a third she join'd the former two."

Thus with the poets, nor was it unlike with the philosophers. Pythagoras, Ptolemy, Copernicus, and Newton did not appear together upon the stage of the world, but were separated by centuries, and Archimedes was not followed by a Watt till more than a score of centuries had passed away between them. Thus the scarcity of immaterial capital also demonstrates its value equally triumphantly with its utility. Splendid talents are not, it will be universally acknowledged, the growth of a day. Nature does not commonly produce men of real and transcendent genius in such numbers as at all to impair their worth.

There is such a wise adaptation in all the parts of the systems of creation and Providence, that wherever a man of genius and mind is produced, a quantity of raw material is found on which he may exercise his talents: and, indeed, if it were otherwise these masterpieces of nature might be esteemed altogether useless, and in some cases even worse than useless; for so great is the anxiety for organic change in the usages of men which these master minds sometimes exhibit, that the author believes that if such men on coming into the world were to find everything perfect, everything right, they would then even strain every nerve to set everything wrong. But of this there is at present no fear. All the mighty minds in the universe may work for ages and centuries in the work of improvement, and yet so scarce are they that much would still remain to be done. BASILIUS.

## IRON COFFINS.

In Lardner's treatise on iron and steel manufactures, to which we have previously had occasion to refer, an interesting account is given of the various purposes to which sheet iron has been applied, such as for boilers, steam-vessels, &c. One of the most singular applications, however, which our times have witnessed, and certainly none of the least feasible, has been its use in the construction of that piece of furniture of man's *ultima domus*, which is usually furnished by the undertaker. In the year 1819, a patent was obtained by an individual of the name of Bridgman, for making coffins of rolled iron: this novel introduction of the material was defended as being better calculated than wood for the protection of the bodies therein deposited, from sacrilegious abstraction for anatomical purposes. The reception, however, of these iron coffins in the metropolitan cemetries was withstood, on the ground that, as they would last much longer than wooden ones, the grave-yards consecrated for the sepulture of the inhabitants of the different parishes would soon become too strait for their accomodation. In order to try the legal validity of this objection, Bridgman, the patentee, made application at the burial ground of St. Andrew's, Holborn, to bury the corpse of a woman in an iron coffin: the funeral proceeded to the ground in Gray's Inn Lane, but the interment was withstood by the parish authorities, the coffin deposited in the bone house, and legal proceedings instituted against the church wardens. This novel case was argued in the consistory court, the most eminent counsel being employed on both sides. In favour of interment in iron, it was contended, that sepulchral chests were of great antiquity; that coffins of stone and lead, as well as wood, had been, or were, in use in this country from very early times, and that even brick graves were every day allowed to be made in all church-yards throughout the kindom. The question to be argued, therefore, was one of right, the law not having specified or prohibited any particular material. On the part of the churchwardens, it was alleged, that the right of the parishioners generally would be greatly infringed by the introduction of iron coffins, as the ground would soon be entirely occupied by them, and, consequently, an act of injustice would be committed. The judge, Sir Wm. Scott, in a luminous summing up, observed, that with reference to precedent it was a well-known fact, that burning the body, and naked inhumation, preceded the use of coffins of any sort; and that among nations civilized as well as savage: and it was remarkable that in the burial service of the church there was no mention made of a coffin at all. It was asserted by one party, that, in point

Digitized by Google

of absolute duration, the iron coffins would not last longer than wooden ones. The learned judge remarked, that, upon this point, it was not without a violent revolt to all the ideas he had formed on the subject, that he heard it affirmed, that coffins formed of iron would not keep longer possession of the soil than those formed of wood: to him it appeared, that without pretending to any experimental knowledge on such subjects, that it must be otherwise; rust was the process by which iron travelled to decomposition; excluded from the air, it remained unimpaired; and if it did from internal moisture, or any small admission of external air, contract rust, that rust, until it scales off, protects the interior parts from further decay; whereas wood corrupts internally, and thus hastens its own destruction. It was ultimately decided that the parish should prepare a table of fees applicable to the reception of iron coffins.

## MISCELLANIES.

*Iron Steamers.*—Considerable and increased facility in the extension and application of steam navigation is expected to arise from the substitution of iron for wood in the construction of vessels. Hitherto iron steamers have been confined to river navigation; but there appears no sufficient reason why their use should be thus limited. For sea voyages they offer many advantages; they are not half the weight of vessels of equal tonnage constructed of wood; and, consequently, with the same tonnage they will have less draught of water, and therefore less resistance to the propelling power. The nature of their material renders them more stiff and unyielding than timber, and they do not suffer that effect, which is called hogging, which arises from an alteration that takes place in the figure of a timber vessel in rolling, accompanied by an alternate opening and closing in the seams. Iron vessels have the further advantage of being more proof against the fracture upon rocks. If a timber vessel strike a plank it is broken, and a chasm opened in her many times greater than the point of rock which produces the concussion. If an iron vessel strike she will either receive a dinge or be pierced by a hole equal in size to the point of rock which she encounters.

*Manufacture of Iron.—The Hot Blast.*—The introduction into Scotland of the system of smelting iron by heated air has produced extraordinary changes in the manufacture of that important metal. The reduction in the quantity of fuel required is said to be no less than 300 per cent.; two tons of coals, or a corresponding quantity of coke now proving to be sufficient for the smelting of one ton of iron, which formerly required upon an average about eight. This would rank amongst the greatest strides of modern art, were no objections to exist in the correspondiug deterioration for general purposes of the quality of the iron so produced. The hot blast has not yet been introduced into the iron districts of England from the supposition that the metal is rendered by it brittle and devoid of that malleability which is one of the finest qualities of iron, and that the saving of fuel is not equal to the decreased value of the metal so produced.

*The London and Birmingham Railway* was opened on the 20th July, and up to the 29th of August last the number of passengers conveyed by it amounted to 59,150.

*Veneering.*—In the time of Pliny the art of veneering was a recent invention; and he descants, in his usual antithetical way on thus converting the cheaper into the most valuable woods, by plating them with these latter; and of the ingenuity of cutting a tree into thin slices and thus selling it several times over. The woods employed for this purpose were the citrus, the terebinth, various kinds of maple, box, palm, holly, ilex, the root of elder and poplar. The middle part of a tree, he observes, shows the largest and most curling veins, while the rings and spots are chiefly found near the root. The veneers, or plates, were secured, as at present, by strong glue.

The only perfectly black wood is ebony from Africa: that from the Mauritius and Ceylon is usually variegated more or less with cream-brown, and is sometimes very handsome; sometimes it produces accidental resemblances to moonlight falling on black clouds.

A singular wood has lately been imported from Russia, where it is dug out of the bogs. Is seems to be a birch; the ground is pale yellowish, but is prettily and singularly variegated by dark curved lines.

*Combination of the Alphabet.*—The 24 letters of the alphabet can be put into 620,745,868,298,973,839,360,000 different positions, and would require (at one million a week) 11,037,420,544,211,035 years to count them in.—J. B. A.

Digitized by Google

# THE CHEMIST.

## ANTIDOTES FOR POISONS.

In consequence of the great similarity in appearance of many chemical preparations, some of which are comparatively innoxious, while others are poisons of a very active kind, it often unfortunately happens that one is taken in mistake for the other. For instance, the crystals of Epsom salts and oxalic acid are so much alike that many persons have been poisoned in consequence of taking the latter for the former. And where cases of this kind occur, it frequently happens that if an antidote could be administered directly the mistake is discovered, the effect of the poisom might be prevented; but so much time is often lost before medical aid can be procured, that the patient is dead or dying before the apothecary arrives. We are induced therefore to lay before our readers the following simple directions for counteracting the effects of the following poisons, which in consequence of most of them being employed in various processes in the arts and manufactures, are more likely to be taken by mistake, or for the purpose of destroying life than others are. Although the antidotes mentioned will, when properly administered, prevent evil consequences, yet we need hardly say that medical advice should be procured as soon as possible.

*The Acids.*—Whenever these are introduced into the stomach the pain is so immediate and acute, that unless the antidote be quickly administered there is but little hope of saving the patient. In the following list we have placed the popular name before the scientific, in order to prevent any possibility of mistake:—

*Aquafortis (nitric acid).*—This is a powerful corrosive poison, and in a short time destroys the coats of the stomach. The best antidote is an alkali with which the acid will combine, and form a compound that can afterwards be removed from the stomach by an emetic or the stomach pump. The antidote most commonly employed is magnesia. Mix a quantity in milk, and force it into the stomach; or if magnesia cannot be readily obtained, give a strong solution of soap.

*Oil of vitrol (sulphuric acid).*—The same means may be employed when this poison has been taken as in the last.

*Spirit of salt (muriatic acid).*—Magnesia or soap should also be administered to prevent the effects of this acid.

*Oxalic Acid.*—Although the crystals of this acid resemble those of Epsom salts, yet if persons were to taste a solution of the latter before taking it, they would prevent the danger of being poisoned, as it differs materially in this respect from a solution of oxalic acid. The taste of the salts is bitter, that of the acid sour. When the latter is taken by mistake, the same remedies should be employed as those just mentioned for the acids above.

It will be seen that for all the above the same antidotes may be administered; those which follow, however, require others of a different kind.

*Opium.*—Persons in the last stage of drunkenness very much resemble those who are suffering from the effects of opium and care should therefore be taken to distinguish between the two before administering the antidote. The symptoms of poison by opium are great paleness of the face, cold sweats, and drowsiness. After the stomach has been emptied by the stomach pump, or an emetic, the patient should be prevented indulging this drowsiness by being forced to walk about. Very often in the hospitals they make patients suffering from this kind of poison walk about for hours, supported, of course, by assistants. Acid drinks and stimulents should afterwards be given.

*Arsenic.*—Produce vomiting, and administer afterwards a solution of chalk and water, or lime water.

*Verdigris.*—Persons are sometimes poisoned in consequence of using copper utensils for cooking that have not been kept clean. The best immediate remedy is to administer large doses of sugar and water until vomiting is produced, and afterwards give small quantities of sugar at intervals.

*Gamboge.*—This is a very active poison. It excites the most violent purging and vomiting when taken in any large quantity. The best remedy is demulcent drinks—milk, &c., and a grain or two of opium, which should be given occasionally till the vomiting ceases.

*Corrosive Sublimate.*—More than one chemist has been killed from having taken this poison by mistake. Albumen, however, is a certain antidote; it coagulates when mixed with corrosive sublimate. If, therefore, a quantity of the white of egg, be given to a person who is suffering from the poison, the sublimate will be decomposed and reduced to calomel, which being a purgative medicine,

Digitized by Google

will evacuate the alimentary canal and prevent any serious consequences. The antidote should, however, be directy administered, mixed with milk or water, otherwise the stomach will be so much injured that the patient will not recover.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—In applying the magic lantern for illustrating lectures, I am desirous to use for slides geometrical and mechanical figures, diagrams, &c., drawn upon paper. I shall feel obliged to any of your intelligent Correspondents to inform me of a simple plan by which the paper may be rendered transparent without injuring the lines or the water colours. A. M.

SIR,—May I take the liberty of asking your Correspondent, "Rugbœnsis," through the medium of your valuable periodical, how he proposes to make the earth revolve 365 times, while the arm E goes round in the astronomical apparatus which appeared in your periodical of August 5. By inserting this you will oblige JOHANNEZ.

Can any of your Readers inform me how to prepare those skeletons of mice and other animals which are seen in shop windows. N. P.

Could Mr. Watts inform me where to make the opening for extracting the brain from birds and fish. N P.

## ANSWERS TO QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—In No. 36 of your Journal a Correspondent inquires into the construction of the London and Westminster boats, which he is informed are propelled by mercury, to which inquiry I beg to give the following reply:—The boats, or rather boat, (for only one, the "Cygnet," of the construction referred to is on that station,) is on Mr. Howard's principle, and has no boiler, but the following substitute for one. A quantity of mercury is placed in a wrought iron vessel over a coke fire, and maintained at a temperature of from 4 to 500 degrees of Fahrenheit. The surface of mercury exposed to the action of the fire is three-quarters of a square foot per horse power. The upper surface of the mercury is covered by a thin plate of iron which rests in contact with it, and which is so contrived as to present about four times the surface that is exposed to the fire: adjoining this is a vessel containing water heated to nearly the boiling point, and communicates with it by means of a nozzle and valve, and the water is from time to time injected by the engine, in small portions, to the top iron plate from which it receives the heat, not only necessary to convert it into steam, but also to expand that steam, being above what it would receive if in contact with water, the temperature being above its pressure; hence the steam passes into a jacket surrounding the cylinder, which jacket is also surrounded by another, forming the passage of the heated air to the funnel, by which means the temperature is preserved at 400 degrees, the pressure being 25 degrees per inch. The arrangement of the slide valves is such that the steam acts expansively. The condenser is a copper vessel immersed in a cistern of cold water, and the steam flows into it by the eduction pipe in the usual manner, and a jet is admitted to it from an adjoining vessel filled before working with distilled water, and the condensed water and the condensed steam are pumped therefrom into a copper worm placed in a cistern of cold water, by which means they are reduced in temperature and then reconducted to the distilled water-tank. A fuller account will be found in the last edition of Lardner on the steam engine, from which, indeed, the above is condensed. Yours, &c. C. D. THOMAS.

P.S. The fire is urged by a blowing machine.

*To Silver Copper.*—The article to be silvered must first be boiled in a solution of alum and cream of tartar. A paste must then be made with water of one part corrosive sublimate, four parts of silver precipitated from a solution of the nitrate of silver, sixteen parts of common salt, and sixteen parts sal ammoniac, which must be spread over the prepared copper. The copper must then be exposed to a heat sufficient to drive off the mercury and then polished. N. P.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Sept. 20, S. W. Butler, Esq., on the Drama and Elocution. Friday, Sept. 22, J. Pereira, Esq., on the Senses, at half-past eight o'clock.

*Eastern Athenæum*, Stepney-square.—Wednesday, Sept. 20, F. Cooke, Esq., on the Genius and Writings of Lord Byron, at eight o'clock.

*Saint Pancras Institution*, Colosseum House, New-road.—Tuesday, Sept. 19, Dr. M. Trueman, on Animal Physiology—Respiration, at half-past eight o'clock.

*Westminster Mechanics' Institution*, 5, Little Smith street.—Thursday, Sept, 21, John Malyn, Esq., on Anatomy—the Bones and Joints, at half-past eight o'clock.

*Islington Institution*, Thursday, Sept. 21, Mr. Jas. Smith, on the Sources of General Happiness, at half-past eight o'clock.

*Tower Street Mutual Instruction Society.*—Monday, Sept. 18, Mr. W. W. Coupland, a Lecture on the Doctrine of Chances, at eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, Sept. 19, Mr. Bolton, on Political Economy, at half-past 8 o'clock.

## TO CORRESPONDENTS.

*Correspondents are in future requested to direct their Letters* "To the Editor, AT THE PRINTER'S, Holloway Press, Islington." *All communications to be Post Paid.*

*If* A. Hewitt *will send us a model of his vertical paddle it will be much better to draw from; we will then insert his description of it, which may be of service to him.*

Johanny.—*We are in the habit of sending up Montgolfier balloons, and one of eighteen feet in circumference, made of tissue paper, will carry about one pound weight. Calico is out of the question altogether.*

Delta *shall be answered at the first opportunity.*

*We have received a Letter from* Jack's Brother, *in answer to* Z. Wigo's *of last week. He must excuse our not inserting it for two reasons; first, on account of its length; and, secondly, because we do not wish to make our columns a means of kindling the flame of discord.*

*We will send* A. B.'s *paachute to our engraver; but we can see but little alteration from that of Mr. Cocking's. The steel rods are decidedly objectionable; for should the parachute take an horizontal position he would find himself in an awkward situation.*

*Received* W. J., A Friend, O. S., A. B., Civil Engineer, *and several others.*

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

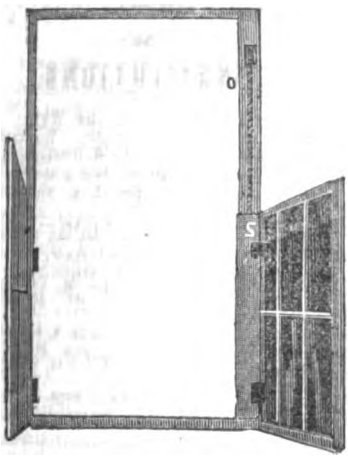
Digitized by Google

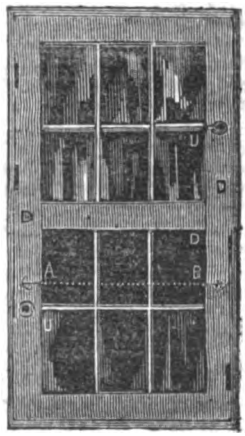
# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. XLVIII.] SATURDAY, SEPTEMBER 23, 1837. [Vol. II.


### WALLINGTON'S IMPROVED WINDOW SASH.

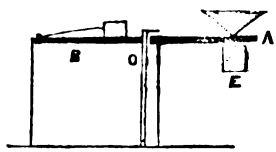
Fig. III. Fig. II. Fig. I.





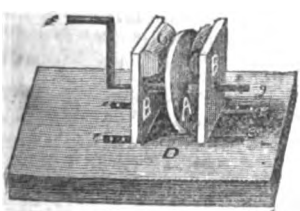

### ELECTRIC BOTTLE.

### RAIN GAUGE.




### ELECTRIC APPARATUS.

Fig. I.



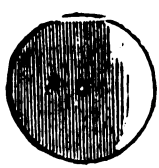
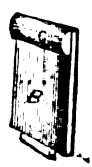



Fig. II.







Holloway Press: D. A. Doudney.



Digitized by Google

## IMPROVED WINDOW SASH.

DESCRIPTION.—Fig. 1, the sash to be made. The two $\frac{4}{4}$ boards, D D, of less thickness than in the common window, so as to allow it to open, as fig. 3, when hinged to the dove-tailed piece, fig. 2, which works up and down in a groove, fig. 3, with the line O, fig. 2, attached on the back, the same as the common sash. The grooves are formed by making the parting-beads and the $\frac{4}{4}$ beads on the bevel, which will prevent the dove-tail piece from slipping out of it when the window is opened. One sash to be hinged on the right hand and the other on the left; and a flush bolt U, fig. 1, let in on the other side of each to fit it to; C, fig. 2, a little hole for the bolt to go into. The dove-tailed pieces must be made the length of the sash. It will be better to lift the window up to the top when it is to be opened, or the line will run up with the dove-tailed piece, and most likely break it off. I have no doubt my plan will be easily understood by persons having the slightest knowledge of carpentry.

---

*To the Editor of the Penny Mechanic.*

SIR,—As my sash opens inside the room, it is very convenient to clean, as it moves up and down when open or shut; and there cannot possibly be any danger of falling out of the window, as the cleaner will stand inside. I think there cannot be a more simple plan than this, as the window will only require unbolting and then to be opened the same as a door: and as to the expense, that cannot be much, for two pairs of hinges and two flush bolts is all the ironmongery required. Certainly there is the fixing to be thought of, and the four dove-tailed pieces which slide in the grooves (with the sash-line attached) on the back of each sash, between the parting-bead and the $\frac{4}{4}$ bead. Your correspondent, Mr. Cowell, in Number 35, has forgotten all about the expense of fixing, and the flush bolts, &c.; also the risk of letting the window slip out of the hand when taking it out or putting it in, and the loss of time, which would be of great consequence to a person who has many to clean. The improvement I propose cannot fail to effect the object in view, as no one can object to merely opening the window. In the improvements noticed in Numbers 21 and 31, I think it is intended to detach one line only of each sash; if so, it is very dangerous, and the windows are liable to be broken. In Mr. Cowell's invention, given in No. 35, I should suppose, it is intended to take the window out; if not that in Number 31 would be far the best and cheapest, as any person who can use a knife may put in the dove-tail wedge, if it should by chance be lost; but it would require a carpenter to fix Mr. Cowell's suspenders, which would of course take some time to do.

I remain yours truly,

L. WALLINGTON.

---

## RAIN GAUGE.

*To the Editor of the* PENNY MECHANIC.

SIR,—I believe that these instruments are made to act by means of a float. Now could not the weight of the water be taken advantage of for this purpose? I should propose the following plan:—Let A D be a balance-beam fixed on the point O, having at one end the funnel and vessel E E, and at the other a sliding weight, put in motion by a horse hair, for instance, fixed on the board supporting the beam: whenever the water accumulated in the vessel E, its weight would raise the opposite end of the lever, and the weight would consequently be acted upon by the horse-hair until it counterbalanced the water received. By this means, if the water should evaporate, still the right quantity would be indicated by the weight. The lever on the side of the weight should be graduated to a certain scale. I remain yours, &c.,

R. O. S.

---

## CHEAP ELECTRICAL APPARATUS.

DESCRIPTION.—Fig. 1 is the whole complete; D is the stand and bottom, merely a piece of wood with two mortice holes made through it, in which holes are fixed the two upright sides, B B, better seen in fig. 2, both being similar. To these sides are attached two cushions (the manner of making these and fixing them is described in page 292 of this work, one to each side, C C. These cushions are to project out from each side so far as to meet, except just room to allow the glass wheel, A, to come between and fit tight, better seen in fig. 1. In this wheel must be fixed a spindle, quite tight, one end of it projecting through the one side, G, and the other the opposite, to which fix a crank, E, to set it in motion. To make the whole more secure and effective, four iron brackets should be screwed to the sides and the bottom, as shown at *e e e e*, which will keep the sides pressing against the wheel, and thus produce the desired effect.

Digitized by Google

*To the Editor of the* PENNY MECHANIC.

SIR,—Having lately seen in your Magazine an article on a "Cheap Electrical Apparatus," and knowing of one quite as simple, as cheap, and effective as that was, at the same time easier to be obtained and constructed by mechanics, I have sent you the foregoing description of it to insert in your periodical, if worthy. I have not entered very minutely into various parts of it, not considering it necessary, as my friend, "E. V. E." has very efficiently already done that; but have, in as clear a manner as possible, simply described its formation and structure.

I am, Sir, yours, greatly indebted,
GEORGIUS.

*To the Editor of the Penny Mechanic.*

SIR,—In No. 37 of your useful Magazine you have given directions for making a "Cheap Electrical Apparatus, which I think would be much easier to make if, instead of making a hole in the bottom of a wine bottle, you were to get a wine bot- or large phial A, which has the bottom turned inwards, and place a piece of stout wire B, exactly in the centre of the bottom, and surround it with cement C C, which may be made as follows: a half-pennyworth of bees wax, a pennyworth of rosin, and a little red ochre, melted together. For one end, and for the end in which the handle is fixed, take a piece of wood D, and fix it in the neck of the bottle; bore a hole in the centre of the wood, and put in it a piece of wire E, in the shape of a handle; a piece of wood is preferred to cork, because, by the continual turning of the machine the hole in the cork would enlarge, and the handle give way. And again; instead of taking a mixture of quicksilver, scraped from the back of a looking-glass, and tallow, you should use a little amalgam; the effect would be better. Amalgam may be made thus: take a piece of zinc the size of a small nut, and melt it in the bowl of a tobacco pipe, and when melted put in an ounce of quicksilver; pour it on a stone to cool, and it will be fit for use.—O**D.

## IMMATERIAL CAPITAL.

NO. V.

WE hope that now our readers are somewhat enlightened with respect to the real value of immaterial capital, its estimated value will be found to be entirely under the dominion of circumstances. The sea is not more fluctuating in its surface, nor the wind more changeable and irregular in its motions, than the price in material gold which this capital bears in the market of the world.

We see our genius, as though the favourite of fortune, borne for ever on the winds of prosperity, far in wealth, intelligence, and influence, above the heads of the rest of the world, seated on a throne which all unite in upholding; receiving homage which all concur and vie in yielding; and exercising power which all consent in supporting. But how seldom is this the case; it is ever the exception, not the rule; a case supplied by circumstances to puzzle the senses of men. The generality of men of science have to struggle with difficulties which would crush scores of ordinary men; they have to contend with obstacles to others unsurmountable, and to combat enemies whose front would awe all others but themselves. And are they always successful in overcoming all, and reaching the pinnacle of fame? Experience answers, no—many of those who were the germs of nature's brightest flowers, doomed to blush unseen as blighted in the bud. Like a certain people of old, in the land of the Pharaoh's, this class of men has become too numerous; means are taken to quench the intellectual zeal which the growth of knowledge has produced; and these not succeeding, care is taken to depress the rising genius as he pants and toils for fame and an honourable subsistence. Cold smiles and scornful inuendos meet his enthusiastic ideas; cold water is thrown upon the flame lest its fervour grow too strong for the people of the land. Nature has bestowed on some minds more enlarged faculties and capabilities than on others; and it was surely intended that the benefits arising from these should be diffused around. But if those who might receive these benefits, and for whom they were intended, obstinately set themselves in opposition to the instruments employed to impart them, and refuse them that support of which they so often stand in need, and to which they are so justly entitled, it is lamentable indeed. Yet this is exactly the state of the case, and reason has to weep that folly and ingratitude should so rule over the minds of men. This sort of capital, of which we speak, is not a saleable article; its properties and value are not understood; men have no faith in the prospects which it presents, and none but the most niggardly advances are made to render it available.

BASILIUS.

Digitized by Google

## HAND-LOOM WEAVERS.

*To the Editor of the* PENNY MECHANIC.

SIR,—Towards the close of the last session of Parliament, a Committee* was appointed by the House of Commons to inquire into the distress prevailing amongst the Hand-loom Weavers. What object the supporters of the motion had in view I am quite at a loss to discover. I carefully perused the debate at the time, and could not find one plausible argument in favour of the motion—not even in the speech of the hon. mover, the friend, *par excellence*, of the Hand-loom Weavers. That the unfortunate hand-loom weavers, both in England and Scotland, are now, and have been for years, in extreme distress—nay, some almost starving—is, alas! but too well known, and need no Committee to prove it. A liberal subscription was lately raised for the relief of the Spital-fields Weavers, but this can, at best, afford only a temporary relief; and therefore the *causes* of the distress should be inquired into, with a view to their remedy. It is now some years since power-loom weaving came into successful operation, and consequently that hand-loom weaving failed: the question, therefore, naturally presents itself, "Why did the thousands who are at present starving engage in the business at all, when they well knew at the outset that they would not be able to gain a livelihood by it? The answer I believe to be is, that great facilities are given for children to enter the business; and it being a characteristic of youth to be fond of earning money, there is no lack of fresh hands willing to engage in it. The plain fact is, that hand-loom weaving, or any other business in which animal power is placed in competition with that of steam, can never again prosper in the United Kingdom, whatever legislative measures may be passed for its relief. This being the case, my advice to the Weaver is—being a sincere friend—that they endeavour to obtain sufficient money by subscription to enable them to emigrate to some country where they may stand a chance of obtaining a remunerating price for their labour, and that no fresh hands, on any account, be instructed in the business.

I am, Sir, yours respectfully,
J. F. S.

* The Committee having been appointed by the late House of Commons is now defunct, but will, most likely, be re-appointed in the ensuing session.

[We are decidedly of our Correspondent's opinion, that whatever subscriptions may be raised for the benefit of the Hand-loom Weavers will give but momentary relief; the immense number of sufferers are too great to be supported by alms. Man must live by his own industry. We consider machinery (when properly applied) to be one of the greatest blessings that can be conferred on mankind; which, as shown by J. F. S. leaves, man but little or nothing to do. The earth still yields the same quantity of food; there is no reason therefore that a man should starve, or become a wandering beggar. The time thus saved by the introduction of machinery ought to be spent in cultivating the mind, in agricultural pursuits; in the enjoyment of manly field and other sports; in roaming over the garden of Nature, enjoying the delightful study of botany, entomology, ornithology, &c.; and in teaching our children the rudiments of education necessary to make them the future good citizens. But why is this not done? It is because men are not sufficiently educated in the laws of nature;—they are disunited. The Creator sends forth men of genius into the world, who, by their inventions, pave the way for man's happiness, but they will not walk in it. The thousands suffer the individual—the Capitalist—to seize the opportunity of engrossing these inventions, and thus, in the end, the whole body are reduced to a state of poverty and wretchedness. If the Hand-loom Weavers, then, cannot get machinery [we do not wish to cast reflections on that body, but we know, from calculations which have been made, that the money spent in Gin Palaces in the Metropolis, if turned into another channel, would soon purchase machinery for all who are injured by it;] and have it placed under the management of their own societies, whereby the whole body may reap the benefit of it, we think, with J. F. S., that it would be much better to raise a subscription and emigrate. We fear it is of but little use trusting to Legislators; they cannot understand the mechanic's wants, having been brought up in a sphere far above him.]

# MANUFACTURES.

## MAKING GUN FLINTS.

BY DR. MITCHELL.

BRANDON, in Suffolk, is the only place in England in which gun-flints are now made to any considerable extent. During the war, and before the invention of percus-

Digitized by Google

sion caps, when the demand for gun-flints was much greater than it is at present, some were made at Lewisham, Maidstone, Purfleet, Greenhithe, and Northfleet; but none are made there at present, although the largest flint-merchant in the world resides at the last mentioned place. The gun-flint makers at Brandon say that they have an advantage over every other place in England, in consequence of the material which they obtain in the pits below their heath being better than is to be had any where else. They say, that the flints which they are enabled thereby to make will last longer than other flints, and are most certain in their fire. This, from information elsewhere obtained, I consider to be true. At Brandon they said that the French no longer made gun-flints, and, in fact, that they themselves were now the only makers in the world, and yet the seventy or eighty men now employed could barely make a living by their trade; the cessation of war, and the invention of percussion caps, had so much diminished their business. The masses of flint from which the gun-flints are made at Brandon are obtained from a common about a mile south-east from the town. The chalk is within six feet of the surface. The men sink a shaft down about six feet, then proceed about three feet horizontally and sink another shaft lower down into the chalk about the same depth of six feet, and sometimes they fall in with a floor of flint within this depth. They proceed again about three feet horizontally, and sink another shaft six feet; and so they proceed, going sometimes to the depth of about thirty feet. By making their shafts only about six feet in depth, they are enabled to descend, and hand up the stone from one stage to another, without the aid of any machinery; and although a windlass, rope, and bucket might save labour, they would require capital, which the poor men who follow this occupation cannot command. They pay a rent of five shillings to the parish for every cart-load, which is as much as three horses can draw, and of this they grievously complain. In the descent of about thirty feet, they generally find three floors of flint, and sometimes as many as four. At every floor of flint which they find they excavate horizontally for several yards, even as far as twenty yards below the chalk. The flint is in large blocks, in form much like the septaria stone. The men break the blocks into moderately-sized pieces, so as to be enabled to hand them up from stage to stage. When engaged in doing this, a man places himself about half-way up between two stages, so as to receive the stone from below, and hand it up to the stage above him. They sometimes sink shafts and do not fall in with flint to repay their labour.

When we look at a gun-flint, and observe its elegant shape, and consider how admirably it is adapted for the purpose intended, we should be apt to think it had been ground into that shape with great labour and skill. Such, indeed, is the manner in which gun-flints, if we may so call them, are made in Germany from agates and conglomerates; but they are much less efficient and more expensive. The art of making gun-flints appears to be very simple; yet I was informed at Brandon, that it is not more than forty years since the present mode was known there, being introduced from France. The origin of the art is kept in recollection by its being called the French mode, as distinguished from the mode formerly in use, which they called the English mode. One of the men in a shop which I visited recollected the time when it was first made known. According to what is called the English mode, pieces were struck off the edges of a block of flint, and when it happened that they were of such a form as would answer, the edges on the sides were broken off, and they were brought into some shape. Such flints were unshapely in comparison of the present very elegant form of gun-flints; there was a great waste of manufacture and material, and only a small number could be made in a given time. Accordingly this mode was soon totally abandoned when the French mode was once known. This mode I shall now attempt to describe. The workman, technically called a cracker, who is seated on a chair, has a thick piece of leather strapped on his left thigh, and over that piece of leather he straps on a thick piece of iron. He takes a large piece of flint-stone, and breaks it into pieces of manageable sizes, about two pounds each: he then takes one piece in his left hand, and applying it to the plate of iron on his thigh, he strikes out fragments at short distances from each other: he then strikes with his hammer on the parts of the edge of the flint, which are now separated from the rest, and the effect of the blow, together with the reaction on the plate of iron on his thigh, causes a flake of about three or four inches in length to come off, there being on each side a conchoidal fracture. Other flakes are broken off in the same manner. Of the flakes thus obtained

Digitized by Google

from the mass of flint, some are large and others small. The workman has before him three small casks with the upper end open; into one of them he drops the larger flakes; into the second the flakes of a less size; and into the third the flakes of the smallest size. When he has broken off so many flakes that there is no longer any good flint left, but only the outer white crust, or such parts as are made of greyish matter, he throws the refuse into a fourth cask, which is beside them, and it is from time to time carried out of doors, and thrown into a heap of rubbish. The three casks with the flakes are intended each of them for a separate workman, who has to finish them into flints, as musket-flints, carbine flints, horse-pistol flints, single-barrel flints, double-barrel flints, and pistol flints. The workmen who divide the flakes into flints are called nappers, and one cracker is enough to keep three of them employed. A napper has before him a block not unlike a butcher's block, upon which a piece of iron is nailed, from which rises a thin piece of iron three inches in length, and only a sixth of an inch in thickness, and brought to a coarse edge. The napper uses a hammer, which is merely a plate of steel extending two inches on each side of the handle, and an inch in breadth, and not above a sixth of an inch in thickness. He takes into his left hand one of the flakes, and lays it over the little anvil on the block, and with his hammer he breaks it into three or four flints. All that he has to do after that, is to see which edge will be best for the flint, and from the other he breaks a little off, and the whole is complete.

At Brandon I was told that, in the present depressed state of the trade, arising from the use of percussion caps, the best musket flints were sold from 7s. to 8s. a thousand, which at one time, during the war, were sold for two guineas.

## MISCELLANIES.

*The British Association for the Advancement of Science* will meet next year at Newcastle. The Duke of Northumberland has been appointed President.

*Deposit of Silt from Salt Water.*—At the meeting of the British Association for the Advancement of Science (Section C, Geology and Geography), Captain Denham stated, that he had been examining the port of Liverpool for 14 years, and he infers, from his observations, that a time will arrive when no access to this port will exist, unless man, by his ingenuity, set bounds to the operation of tidal action.

*Power of the Steam Engine.*—In three Engines, at Huel Towan, East Crinnis, and Binner Downs, in Cornwall, the relative duties performed by one bushel of coals are respectively, 86, 73, and 73 millions of pounds lifted one foot high, and 1085, 870, and 1006 *tons*, lifted the same space, *for one farthing expense*. Messrs. Taylor and Galloway have stated, that by the consumption of *one* bushel of coals, they have been able to raise 125 millions of pounds one foot high. It appears doubtful, however, whether the duty from such a quantity of coals ever much exceeds 90 millions.

*Power of a Locomotive Engine.*—"The Elephant," a locomotive engine on the Bodmin and Wadebridge Railway, a short time since, drew up the enormous weight of 58 tons, including itself and waggon, over an ascent of 1 in 45, and going at the rate of 5 miles per hour.

*Expense of a Steam-Boat*—A steam-packet of 100-horse power, equipped as it ought to be, costs about 20,000l.; expenditure of fuel, wages, and victualling, about 250l. per month; tonnage duty, lights, pilotage, and port charges, 200l. per annum; insurance 100l. per month; small repairs and winter expenses about 500l. These items, with the expenses of a boiler, which amounts to about 1500l. in the ten years a vessel is calculated to last, and a reserved fund of about 2000l. per annum for the construction of another vessel, makes, altogether, the sailing expenses of such a vessel about 1000l. per month.

*Vegetation in Arsenic.*—M. Gilgenkrantz states, in the *Journal de Pharmacie*, that he has seen a plant, of the genus *Leptomitus*, form in a solution of arsenic. This observation proves that arsenic, a substance so very poisonous, and supposed to be destructive to all organized bodies, is however favourable to the vegetation of some plants. M. Dutrochet observed the development of a similar plant, about ten years ago, in a solution of acetate of lead.

*Analysis of Indigo.*—M. Dumas, after repeated experiments on this substance, states its composition to be the same as that which he discovered it to be fifteen years since—viz.

| | |
|---|---|
| Carbon..... | 7·30 |
| Hydrogen .. | 4·0 |
| Nitrogen .... | 10·8 |
| Oxygen .... | 12·2—100·0 |

Digitized by Google

# THE CHEMIST.

## CONSTITUTION OF WATER.

The ancient philosophers supposed that there were but four elements, whose agency produced all the varied phenomena of nature; these elements were air, earth, fire, and water; and when we consider what numerous changes they are capable of producing, we need not be surprised that they should have been considered the most important agents in nature. Modern chemistry, however, has shown that the ancients were much mistaken in their views respecting these elements. Instead of their being simple, three of them, at least, have been proved to be compound bodies. The air, the earth, and water are all the products of the combination of a few elementary substances; and fire is the result of intense chemical action between the particles of matter under peculiar circumstances. As far, however, as the production of the various phenomena of nature is concerned, water may still be considered one of the most powerful agents with which we are acquainted. It is impossible to enumerate the effects it is capable of producing; there is scarcely a chemical change that can take place in which it is not concerned, either in its natural state, or in combination with some other substance; and it forms an important part of all organized beings. Our limits prevent our entering into a description of its more important properties at present; we can now only describe its chemical constitution.

Water is a compound of oxygen and hydrogen, in the proportion of one volume of the former to two of the latter; or, according to the atomic theory, of one atom of oxygen and one of hydrogen. The atomic number is therefore nine. That water is composed of these elements may be proved in a most satisfactory manner by the following experiment. Procure an iron tube, open at both ends, and to one end lute the neck of a retort containing water; to the other end fix a small tube, the end of which is to be placed under a receiver in a pneumatic trough. Then place the barrel horizontally in a furnace, and when it has become red hot, heat the water in the retort and form steam. The steam will pass through the red-hot tube, and in doing so will be decomposed. The iron tube has a greater affinity for the oxygen of the water than the hydrogen has for the oxygen, and the latter will accordingly enter into combination with the hot iron, forming oxide of iron; the hydrogen will consequently be liberated and pass through the tube into the receiver. This experiment, which may be easily performed, will prove water to be a compound of oxygen and hydrogen, but it will not prove in what proportions they unite. This, however, may be ascertained by the following experiment. Provide two tubes, closed at one end, and into the other end of each place a cork; let two pieces of platina wire be passed through the corks and communicate by their extremities outside the tubes with the negative and positive poles of a galvanic battery. When a stream of galvanic electricity is made to act upon water thus situated, oxygen gas will be given off from the end of the wire connected with the positive pole, and hydrogen from that in connection with the negative pole. The gases will rise to the top of the tubes, and it will then be seen that the hydrogen is exactly double the quantity of the oxygen. If iron wire be employed in this experiment instead of platina, or some other substance not easily oxidized, very little oxygen will be found in the tube; instead of ascending in the tube it will oxidize the wire. A mixture of the gases forming water may be obtained by those who possess a galvanic battery by passing the wires, connected as in the last experiment, through a cork in a single tube, and decomposing the water. If the stream of galvinism be then continued till the points of the wire in the tube are uncovered by the water an explosion will take place, and the water that has been decomposed will be again formed. The composition of water may be proved by synthesis as well as by analysis. If one volume of oxygen and two of hydrogen are passed into a strong glass vessel containing two wires from a battery, when the electric spark is produced the gases will explode, and a dew will be formed on the inside of the glass; this is the water produced by the combination of the gases. If a jet of hydrogen from a bladder or a Woulfe's bottle be ignited, and a glass tube open at both ends, like a lamp-glass, only longer and of less diameter, be placed around it, the hydrogen will enter into combination with the oxygen of the atmosphere, and a dew will be formed in the inside of the tube, as in the experiment last described. By these experiments the true composition of water may be ascertained with a beautiful degree of exactness. Indeed, there are few chemical experiments more satisfactory than those by which this liquid may be formed or decomposed.

---

Digitized by Google

## QUERIES.

*To the Editor of the* PENNY MECHANIC.

SIR,—In the Adelaide Gallery there are some beautiful specimens of leaves of plants which have been anatomised by some process which the exhibiter is willing to explain.

Not residing in London, it is out of my power to make a personal application to the exhibiter, but it is probable that you, or some of your numerous readers, may have received the information which I wish to obtain, and if such should be the case, the insertion of it in an early number will extremely oblige, amongst many others, your constant reader.

G. D. S.

*To the Editor of the Penny Mechanic.*

SIR,—I am about constructing a balloon with wings, which I think will make the descents much safer than they are at present; because, if the voyager has parted with all his ballast, and is descending from a great height, he may not be able to see the exact nature of the ground beneath him; and supposing there are houses under him, he will with my balloon, be able to rise again and make another descent in a safer place. I have got everything at hand to proceed with the balloon excepting the solution of India rubber, which I believe, is laid on the balloon as a varnish. Not knowing how to make it, you will much oblige me if you will insert in an early number the best receipt for it. PICKWICK.

SIR,—I shall feel greatly obliged if any of your correspondents will inform me of the best method of cleaning silver and plated goods, such as teaurns, waiters, &c., and also German silver The object is to obtain a fine polish. I am, Sir, your obedient servant, F. S. S.

SIR,—Can any of your numerous Correspondents inform me what will make a varnish for boots or shoes, which, when applied, shall produce a brilliant jet polish without the aid of a shining-brush, also without proving injurious to the leather.

Your constant reader, W. J.

SIR,—Having heard of a valuable improvement that has lately been made in steam engines by a certain Mr. S. Hall, I herewith take the liberty of addressing you, and of asking the favour (if you can obtain any information regarding it) to communicate it to me through your valuable magazine. I remain, Sir, your obedient servant, A. B.

SIR,—Will you, or some of your readers, be kind enough to inform me of the best shape and material for constructing a kind of chimney for the collection of carbon deposited from the smoke of a substance burning underneath, for the purpose of making black, on a small scale? S. R.

SIR,—Will you be so kind as to inform me of the best way to make japan for tin? An early answer will much oblige W. D. F.

SIR,—You will much oblige me by inserting the following queries in your well-deserving and widely-circulated periodical:—The best and quickest method of making blacking; the best receipt for making black ink; and also the powder which I have seen in the stationers' windows? I am not acquainted with the name of the powder to which I refer, otherwise I would state it. G. H.

If a steam engine had only to work one side of a piston, would it exert double the force on that side with only the same pressure on the bodies?

B. G.

SIR,—I should be much obliged if you or any of your Correspondents would inform me of the composition, called Dr. Winn's, or Cartwright's, black and blue reviver. I am, Sir,

A CONSTANT READER.

## ANSWERS TO QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—I beg to inform "A Subscriber," that lime, from the most beautiful marble down to common chalk, are carbonates. Lime contains no particular heat more than other bodies. All bodies contain a latent heat. Water gives out its latent heat when poured upon lime. It is a general law in chemistry that all fluids, upon being converted into solids give out their latent heat, and solids being converted into fluids absorb heat. I am, Sir,

A CONSTANT READER.

Fulminating silver is the article that must be purchased by "James Dunn;" but the following recipe, we think, will suit him better, being much safer:—*Matches for Instantaneous Light.*—Oxymuriate of potash, flower of sulphur, of each ten grains, vermilion two grains, oil of turpentine a sufficient quantity to make a paste, with which coat the ends of slips of wood previously dipped in oil of turpentine and dried.

2. Oxymuriate of potash nine grains, sugar three grains, flour of sulphur two grains, vermilion one grain, wheat flower two grains, spirit of wine a sufficient quantity to make a paste, with which coat the ends of slips of wood previously primed with camphor dissolved in spirits of wine. When these matches are plunged into oil of vitriol and immediately withdrawn, they take fire instantaneously. To prevent the oil of vitriol from spilling if the bottle should accidentally fall on one side, pounded asbestos, or sand, is put into the bottle to soak up the acid. J. R. W.

If "Sam Weller" will favour Mr. Barrett, the large coffee rooster of Holborn-bars, with an order, we have no doubt he will show him the whole process.

We beg to inform "An Admirer of the Penny Mechanic," that "hydrogen gas procured from coal," can be burned from a common stone bottle, provided it be fitted with a proper stopcock. The "Portable Gas Company" often supplied it in this way. By no means trust to a bladder.

## TO CORRESPONDENTS.

*Correspondents are in future requested to direct their Letters* "To the Editor, AT THE PRINTER'S, Holloway Press, Islington." *All communications to be Post Paid.*

Pickwick *can send us his parachute; if worth public notice, we will give an engraving of it.*

*We will endeavour to find room for* S. R.'s *experiments.*

*We are obliged to* N. P. *for his paper on the manufacture of glass.*

G. B. *shall be inserted the earliest opportunity.*

Q. E. D. *is rather severe with some of our Correspondents. He must bear in mind that this work was established for the purpose of giving men of limited education an opportunity of making known their inventions; and also for inserting any questions they might wish to be answered by our more intelligent Contributors. We nevertheless like the style in which the letter is written, and will endeavour to find room for it.*

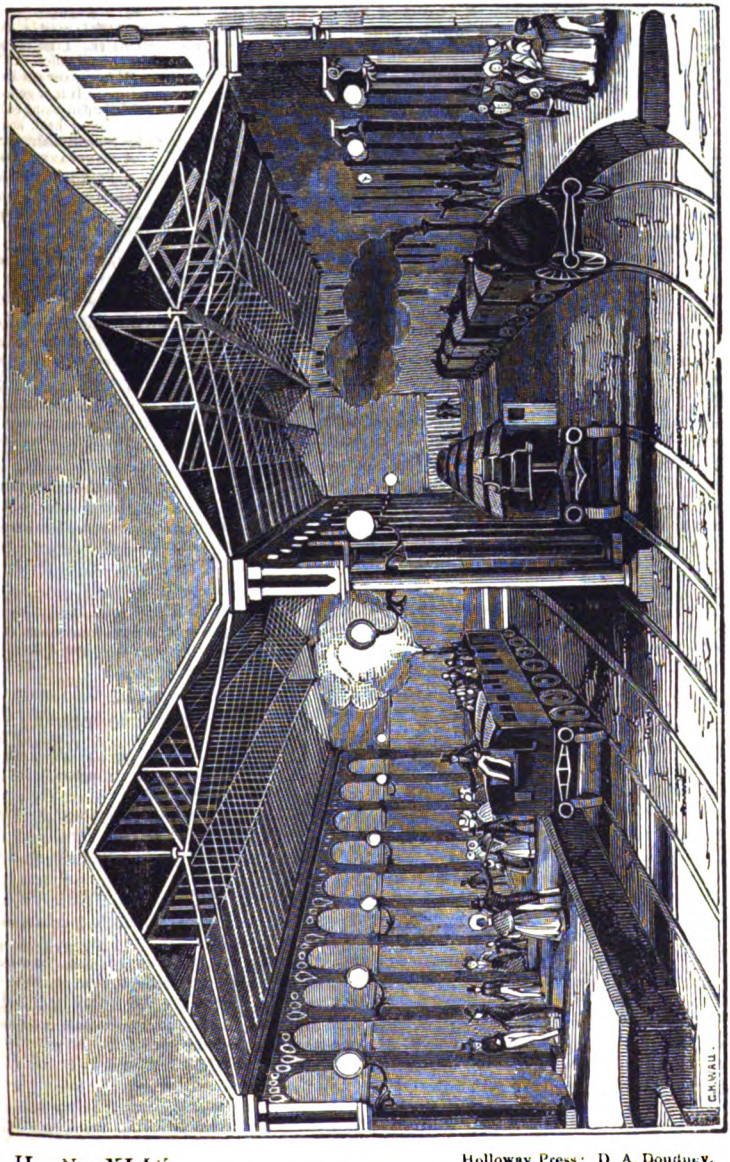
London: Printed at the Holloway Press, by D. A. DOORNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,

## AND THE CHEMIST.

No. XLIX.] SATURDAY, SEPTEMBER 30, 1837. [Vol. II.

LONDON AND BIRMINGHAM RAILWAY STATION, EUSTON-SQUARE.


Vol. II.—No. XLIX.

Holloway Press: D. A. Doudney.



Digitized by Google

## THE LONDON AND BIRMINGHAM RAILWAY.

We this week present our readers with a view of the canopy at the entrance of the line near Euston-square. Its extent is somewhat considerable, and capable, we should say at a glance, of covering not less than two hundred carriages. On entering the passengers' gate from Euston-square, you pass along a short gravel path, which leads to a commodious range of buildings (as seen on the right-hand of our engraving,) occupied as offices for the delivery of passengers' tickets, booking of goods, &c. Through this building persons are directed to the grand depôt of the company's carriages. To prevent accidents, (which might occur were persons allowed to walk on a level with the line of rails,) a platform is raised sufficiently high for passengers to step in and out of the carriages with ease and safety. The time of starting having arrived, the doors of the carriages are closed, and, by the assistance of the conductors, the train is moved on a short distance towards the first bridge, where it is met by an engine which conducts it up the inclined plane as far as Chalk Farm. Between the canal and this spot stands the station-house for the engines; here also are the fixed engines which are to be employed in drawing the carriages up the inclined plane from Euston-square, by a rope upwards of a mile in length, (the cost of which was upwards of 400*l.*); beyond this again, on the right of Chalk Farm bridge, is another range of building occupied as workshops for building the carriages, cattle-waggons, &c. The engines now are changed, and the whole train passes on at a rapid rate through the most delightful country conceivable. Entering the tunnel—from broad day-light to the most perfect darkness—has an exceedingly novel effect: indeed, the scene whole presents a most animating appearance.

We took an early cup of tea a few evenings since, and left London by the five o'clock train, and, what with the rapidity of the conveyance—the great number of social companions—the change of scenery —*under* hill and *over* dale—we certainly were never more gratified; and we recommend our numerous readers not to attend to the newspaper tales daily promulgated (by timid persons of the old school, whose ideas and habits will not allow them to travel more rapidly than by go-carts, or else by parties interested in the existing stage-coach or canal monopolies,) of the numerous accidents attending steam conveyance on railroads; in our opinion, accidents occur more frequently, and are more likely to do so, by the old than by the new mode of conveyance. But a short time since we ourselves were in imminent danger of losing our lives, while travelling by the stage-coach. We recommend our readers to take a trip to Boxmoor by the Birmingham Railway, confident it will afford them equal gratification with ourselves.

*To the Editor of the* Penny Mechanic.

Sir,—As this is my first appearance in your publication, I beg you will indulge me with the space of two or three columns by way of introduction.

In apologizing to your correspondents for the unreserved manner in which I express my disapprobation wherever I detect error, I beg to assure them that I do so without the slightest feeling of ill-nature or disrespect. My only object is the propagation and elucidation of truth; but, unfortunately, it is otherwise with many persons; they choose to persist in their error rather than acquire the knowledge of truth at the expense of their foolish and puerile vanity. But let them reflect that "Du choc des opinions nait la verite." No man is exempt from error, therefore no one should repine because he is compelled to acknowledge that he is not always right himself, but patiently submit to an infirmity which is inseparable from human nature and which we all must bear, in common with Euclid, Kepler, Newton, and Agnew.

*Parachutes.*—I really did indulge in the hope that the epidemy was abating, and that I should see no more pictures and writings relating to parachutes; and it is with regret I now feel myself called upon to make the following remarks upon the subject: as a "profession de foi." I must state that I am an admirer of aerostation, and entertain sanguine hopes that it will ultimately become a source of real and general benefit to society; for although it is impossible to guide a balloon by means of sails, and no application of the arts we at present possess will produce sufficient force to guide it by other means, still it is far from demonstrated that sufficient force will not be obtained at some future period. Even now, Mr. Green has shown that it is a safe conveyance out of any country, which alone is upon some occasions an important object. It may also be applied with great benefit to medical purposes; and many other

Digitized by Google

cases might be adduced showing its actual or probable utility; besides these, it may be applied to many purposes which have not yet occurred to us.

The capability of detaching a person from a balloon with the probability of his descending in safety is unquestionably a valuable addition to the aerostatic art; this object may be easily attained by suspending a small balloon under the car of the principal one. About one-fiftieth the capacity of the Vauxhall balloon would sufficiently moderate the descent of one person, and he might take enough ballast to protract his descent for a short distance should he be about to land in any inconvenient place. After discharging the gas the balloon might be placed in the car, and in that state it would be much more easily conveyed than a cumbrous parachute thirty feet in diameter, and to which would frequently be added the mutilated body of the experimenter. My first objection to parachuting is, therefore, that it is utterly useless. As an illustration of the theory of resisting fluids it has proved a total failure: not a single fact or observation worthy of repetition has been elicited: all that have fallen under my notice are constructed in utter ignorance of hydrostatics; the various schemes that have been proposed are either unsupported by any reasoning at all, or founded upon false and grossly absurd doctrines. One recommends a weight to be tied to the bottom in order to "keep it steady;" another says, there should be a hole in the centre to "let out the condensed air," and strange and inconceivable as it must appear to every scientific man, they have all, without a single exception (that I am aware of) made them strike the air obliquely. The surface most resisted is that which presents no convexity, and is at right angles with a direction of its motion, which, of course, must be a horizontal plane. The only proper form for a parachute, and almost the only one which the whims of projectors have not accidently hit upon. A concave surface, indeed, possesses the property, provided there be no perforations in it; but even then, it would not be applicable in this case, on account of the oscillation it occasions when any alteration takes place in the horizontal motion of the air. The different forces which combine to produce this motion cannot be conveniently described without another drawing of a parachute, to which I have a particular objection; but any person acquainted with mechanical science can easily calculate their effect. As for the velocity of descent through a quiescent medium, every datum that can be postulated is given; the force of gravity, the weight of the machine, the inertia of the air, and area of the surface acting upon it. A mere smattering of mathematical science will enable any person of ordinary capacity to make this simple calculation.

Upon some future occasion, I shall give a minute description of a parachute so constructed as to produce any required velocity of descent with the least possible weight, or greatest possible strength. At the same time, I disclaim the intention of sanctioning the use of such machines for the purpose of descending from a balloon; my chief object will be, to exhibit the perfect beauty of mechanical science when properly applied.

"J."—I fear this instrument will not produce the effect required; reflect again, Mr. J. and Mr. G. *a fortiori*. The cylinder must be made of strong cast brass, or something equivalent to it; the pressure upon a cylinder of the dimensions described by "J." would be above 500 pounds. There must be a valve to the part connected with the receiver and another to the piston.

"H."—I once commenced a collection of butterflies. The first difficulty I had to encounter was to kill them without injuring their plumage; the next was, to prevent the depredations of small insects, which soon destroy them if unprotected. I applied to a friend who is a great connoisseur in these matters, and his instructions were to this effect:—place the patient on a card, and pass a pin through the middle of that part of the body to which the legs are attached; it must be pushed nearly up to the head to prevent the wings from rubbing against it; then put the end of the pin which protrudes on the opposite side of the card into the flame of a candle, and all motion will soon cease. Spread out the wings with other pins inserted in the card till the joints become stiff, and then fix him in his place of destination, which must contain a piece of camphor; this, I am told, will effectually exclude all vermin.

"A. M."—No process will render paper sufficiently transparent to show the figures distinctly with a magic lantern: it is a much better plan to smoke the glass over a candle, and mark the figures with a point; it is easy to contrive a ruler and rest for the compasses a little elevated from the surface. The effect is brilliant.

"N. P."—I have obtained perfect skeletons of small animals by placing them in ants' nest. The skeleton of a lizard is

Digitized by Google

a very beautiful object; the hard skin and every other part except the bones is soon destroyed. If an egg be placed amongst a large congregation of ants they will immediately attack every part of the surface, and form a curious pattern of curved lines upon it; but it must not remain too long, or they will entirely demolish it. It is better to take off the skin of a mouse on account of the hair. I must mention, that I made these experiments on the mountains of Switzerland, where the ants are larger and more numerous than I have observed in England—some of their cities are four or five feet in height.

Having answered these questions, perhaps you will allow me to ask one:—will Basilius oblige his readers with the name of the gentleman who appeared "fifteen hundred revolving suns" after his favourite Virgil? I have heard of a gentleman resembling "two single gentlemen rolled into one," who lodged at a baker's some time ago; but that would imply a glaring anachronism. I am fairly puzzled —I give it up. Adieu till next Saturday,

Q. E. D.

## MECHANICS' LIBRARY.

*The Walk*, by William Robson. Smallfield and Son, Newgate-street.

This work is written in the form of a dialogue, which is supposed to take place between a father and his son during a walk in the country; and the object is to show how much pleasure and amusement may be derived by a cultivated mind, from contemplating even the most familiar productions of nature, in consequence of the literary associations that are connected with them. A further object of the work is to explain the author's views respecting the best plan for communicating information to the young. We are much pleased with the book, and have seldom found so much useful and interesting matter contained in so small a compass. History, biography, the fine arts, and short notices of remarkable persons, events, and things are so pleasantly intermixed that the reader is amused and instructed at the same time. A few such books as the present would prove exceedingly useful to those whose time and opportunities for obtaining knowledge are limited, and we hope the author will be induced to publish more of a similar kind. The low price of the volume is not its least recommendation. The following extracts will give the reader some idea of the manner in which "The Walk" is written:—

Speaking of two of the elements, according to ancient philosophy, the author remarks, "There are certain blessings of Providence, which, from their being always at hand, and always in use, we do not estimate as we ought. Such, for instance, as fire and water. Man is not raised higher above the beasts, particularly some of them, by comparing his reason with their instinct, than he is by his knowledge of the uses of fire. No animal whatever, except man, has the command of this element. The elephant, the beaver, the bee, with all their wonderful sagacity, have no idea of, or power to use, fire; and by the employment of it, more than by any other means, does man evince his superiority. In the absence of a knowledge of the true God, no worship has ever appeared to me so worthy of rational creatures as the worship of the sun and of fire. The sun is, in fact, the visible deity, the dispenser of life and all its blessings to creation; and his emblem and prototype placed in the hands and in the service of man, is fire. Following the above idea, we shall find, that in the time of Zoroastes, the Persians, who were worshippers of the sun or fire, were further advanced in civilization than most other nations; and the Peruvians, who were likewise worshippers of the sun, were by far the most humane and polished people of the new world. But we shall perceive that all the things which are best for us, that is most calculated to procure us comfort and happiness, are not only given us in the greatest abundance, but, as has been observed by the amiable St. Pierre, if we examine these things, we shall find they are not only the most salutary, but the most delicious of the productions of nature. Upon which luxurious food could man feed so long, without being cloyed as upon bread? What highly seasoned meat could, for thousands and thousands of years, be relished by countless people, like the rice of the east? Roman emperors and epicures might covet dishes made of the brains of nightingales; but I verily believe that every unsophisticated palate would prefer to them a slice of our home-made bread and home-made butter. In most cases of epicurism it is the difficulty of procuring the favourite dish, and the price it costs, that constitutes its value." After some interesting observations on the beneficial uses of water, we have the following description of the means by which Venice is supplied with it. "Venice is built upon a great number of islands, connected by bridges; and these islands are in lagunes, or salt-water lakes. Thus situated, it might be

Digitized by Google

supposed that fresh water, unless fetched from the main land, was not to be had in Venice. On the contrary, they have always plenty; and this is the way in which they come by it: the vaults, or cellars, under the houses are occupied as reservoirs for containing rain-water in large quantities. In the centre of a large vault a circular well is constructed, either of stones or bricks, jointed and bedded with a sandy loam. When this well is intended to contain a very large quantity of water its diameter is regulated accordingly; and where space is wanting it is sunk below the floor of the vault, care being taken to build it so as to exclude every adventitious supply of water, which is best accomplished by building with terrace or puzzolona. That part of the well which rises above the floor of the vault is laid with a small declivity from every side towards the well in the centre. At the end, or at both ends of the vault, a semicircular space is cut off by a wall of the same construction as that of the well above the level of the floor. These spaces, and indeed the whole of the vault, excepting the well, are then filled with the cleanest and purest sand that can be procured, nearly up to the edge of the well, and into these semicircular spaces the water is conveyed by pipes from the roofs of the houses. Here the water makes its first deposit of the filth which it brings from the roofs; and therefore this is kept in a separate chamber, that it may be more easily cleansed by renewing the sand, which may be necessary every four or five years; whereas once in twenty years will suffice for the intermediate space. The water is next filtered through the adjoining semicircular wall, and gets into the great body of sand in the large division of the vault; from this it transudes into the circular wall in the centre, where, in passing through the circular wall, it gets its fourth and last filtration, and is drawn pure from the well. The advantage of such a mode of saving water, in a hot country like Venice, where rain only falls twice a year in any quantity, must be very great.

## AMUSING EXPERIMENTS WITH THE AIR PUMP.

*To the Editor of the* PENNY MECHANIC.

SIR,—Having seen, in Number 47 of your Magazine, a simple, but very suitable drawn model of an air-pump, I have sent you a few experiments, which may be performed with the same; and if you think them worthy of a place in your columns, and that they would contribute to the amusement of the readers, I shall be greatly obliged by your inserting them.

EXAMPLE I. Lay a square of glass on the top of an open receiver and exhaust the air; the weight of the external air will press on the glass and smash it to atoms.

II. If a person hold his hand on an open receiver, and the air be exhausted, it will be fixed as if pressed by a weight of sixty pounds.

III. Take water, made warm enough that you can but just bear your hand in it, but that has not been boiled; put it under the receiver and exhaust the air; bubbles of air will soon be seen to rise, at first very small, but presently becoming larger, and at last so great, and rising with such rapidity, as to give the water the appearance of boiling.

IV. Take a stone, or any heavy substance, and putting it into a large glass of water, place it in the receiver. The air being exhausted, the spring of that in the pores of the solid body, by expanding its particles, will make them rise on its surface in numberless globules, resembling the drops of dew on the tops of the grass.

V. To a piece of cork tie a small stone that will just sink it, and putting it into a vessel of water, place it under the receiver; exhaust the air, and the bubbles of air expanding from its pores, will adhere to its surface, and render it, together with the stone, lighter than water; and consequently they will rise to the surface and float.

VI. Take a shrivelled apple, and, placing it under the receiver, exhaust the air. The apple will be plumped up, as the air in the apple extends it; so much, indeed, that it will sometimes burst.

VII. Fix a small bell to the wire that goes through the top of the receiver; if you shake the wire the bell will ring while the air is in, but when it is drawn off the sound will become faint by degrees till no sound will be heard.

VIII. At the end of a fine balance hang a piece of lead, and at the other as many feathers as will poise it; then place the balance in the receiver; as the air is exhausted the feathers will outweigh the lead.

IX. Construct a figure of Bacchus, seated on a cask; let his belly be formed of a bladder, and let a tube proceed from his mouth to the cask. Fill this tube with coloured water or wine, and place the whole under the receiver. Exhaust the air, and the liquor will be thrown up into

Digitized by Google

his mouth. While he is drinking his belly will expand.

X. Take a bladder, in which is but a small quantity of air, and a piece of lead to it, just sufficient to sink it if immersed in water; put it into a vessel of water under a receiver, and exhaust the air, and the bladder will expand, become a balloon lighter than the water, and ascend, carrying the weight with it.

I am, Sir, yours obliged, S. R.

## MANUFACTURE OF GLASS.

Glass is a manufacture of great beauty and utility; it has contributed greatly to the advancement of science, and to the promotion of the comfort of mankind. The manufacture of this useful article was understood at a very early period. According to Pliny, it was accidentally discovered by some merchants, who, with a ship laden with soda, had cast anchor at the mouth of the river Belus, in Phœnicia, and were dressing their dinners on the sand. They employed some pieces of soda to support the kettles they had placed on their fires; the heat melted the soda and sand together, and the result was glass. This manufacture was carried to a considerable degree of perfection amongst the ancients; but perfectly transparent glass was very valuable; for Nero gave 6,000 sesterces (about 50,000l.) for two glass cups with handles; this proves that their processes were not so perfect as ours. Glass was not used in windows previously to the third or fourth century; and then, and long after, it was used only in churches and in other public buildings. The materials employed in the manufacture of glass are alkalies, earths, and metallic oxides. The alkalies may be used indifferently, but soda is generally preferred. The earths are silica, lime, and sometimes alumina. Silica constitutes the base of glass; it is employed in the state of sand, flints, and for making very fine glass, rock crystal is sometimes employed. Lime renders glass less brittle, and enables it to withstand the action of the atmosphere; but it must not exceed the twentieth part of the silica employed. The metallic oxides are the red oxide of lead, and the white oxide of arsenic. The red oxide of lead increases the fusibility of the glass, gives it greater tenaciousness when hot, increases its refractive power, and enables it to bear sudden changes of temperature; but when added beyond a certain proportion it injures its transparency and whiteness. The white oxide of arsenic answers the same purposes as that of lead, but it is seldom employed on account of its poisonous qualities; when added beyond a certain proportion it renders the glass opaque and milky.

The glass is manufactured as follows:—The glass pots are placed round a dome-shaped furnace, built upon arches, and open beneath for the free admission of air: there are generally six in each furnace. The furnace is so constructed that a current of flame may be directed round each glass pot, which afterwards passes out with the smoke into the dome and chimney, heating a broad covered shelf in its passage, which is the annealing oven. The materials, or fret, being fused, and the impurities removed, air bubbles, occasioned by the separation of the carbonic acid from the soda, are extinguished, and at length the glass appears uniform and complete; the fire round each pot is then damped, till its contents require a consistency for working; the whole process requiring about forty-eight hours from the time the pots are filled. At the working heat, which is a full red, glass has a peculiarly tenacious consistency; and as it adheres but feebly to polished metals, it is easily wrought with iron tools. If the glass vessels, after their formation, were allowed to cool very rapidly, they would contract unequally, and become very brittle. To prevent this they are placed in a large red hot oven, which is allowed slowly to cool to the temperature of the air. This process is called annealing. The principal kinds of glass are flint, crown, and bottle glass. Flint glass is the most transparent and beautiful; it is formed of soda, pounded flints, and oxide of lead. Crown glass is used for the panes of windows; it contains no lead, but is composed of soda and fine sand. Bottle glass is the coarsest; it is composed of kelp, or the refuse of soap-boilers, and common sand: its green colour is owing to the presence of iron. Of these species the most fusible is flint glass, and the least fusible bottle glass. Flint glass melts at a temperature of 19°, Wedgewood, crown glass, at 30°, and bottle glass at 47°. Glass is often tinged of different colours, by mixing with it, while in fusion, one of the metallic oxides. Blue glass is formed by means of oxide of cobalt; green, by oxide of iron or copper; violet by oxide of manganese; red by a mixture of the oxide of copper and iron; yellow by the oxide of silver; purple by the purple oxide of gold; and white by the oxide of arsenic or zinc. N. P.

Digitized by Google

# THE CHEMIST.

## CHEMICAL TESTS.

*To detect Copper in Pickles or Green Tea.*—Put a few leaves of the tea, or some of the pickles, cut small, into a phial, with two or three drachms of liquid ammonia diluted with one-half the quantity of water. Shake the phial; when, if the most minute portion of copper be present, the liquid will assume a fine blue colour.

*To determine whether Wheat Flour or Bread be adulterated with Chalk.*—1st. Mix with the flour to be tried a little sulphuric acid; if chalk or whiting be present an effervescence (caused by the discharge of the carbonic acid of the chalk) will take place; but if the flour be pure no effervescence is produced. 2nd. Pour boiling water on some slices of bread, and pour into the water a little sulphuric acid; if there be chalk in the bread an effervescence ensues.

*To discover whether Bread is Adulterated with Alum.*—The bread must be soaked in water, and to the water in which it has been soaked, a little of the solution of muriate of lime must be added; upon which, if any alum be present, the liquid will be pervaded with milkiness; but if the bread be pure the liquid will remain *limpid*. Rationale: sulphuric acid has a stronger affinity for lime than for the alumina and potass, with which it forms alum; it therefore quits those bodies to form sulphate of lime with the lime of the test, which produces the milkiness.

*Test for the Purity of Magnesia.*—The common magnesia of the shops (which is a carbonate) is frequently adulterated with chalk. This may be detected by adding a little diluted sulphuric acid, which, with magnesia, forms a very soluble salt, but with lime a very insoluble one. Pure magnesia (called calcined magnesia in the shops) dissolves in diluted sulphuric acid entirely and without effervescence.

*Test for the Purity of Wine.*—Put into a phial sixteen grains of sulphuret of lime (prepared by exposing to a red heat, in a covered crucible, equal weights of powdered lime and sulphur) and twenty grains of cream of tartar; fill the phial with water, cork it well, and shake it occasionally for the space of ten minutes. Separate the clear liquid by decantation, and preserve it in a well-stopped bottle for use. A portion of this liquor, fresh prepared, when added to wine containing lead, produces a blackish precipitate.

*To Distinguish Iron from Steel.*—Let a drop of diluted nitric acid fall on the metal, and after a few minutes wash it off with water. If the metal be steel a black spot will be left on it; if it be iron a whitish-grey spot will remain. Rationale: the nitric acid dissolves the iron in both cases, but the charcoal that enters into the composition of the steel remains undissolved, and constitutes the blackness.

*Test for the Purity of Volatile Oils.*—Many of the volatile oils being produced in small quantities are high priced; there is therefore some temptation to adulterate them with fixed oils to increase the quantity. To detect the fraud let a single drop of the suspected oil fall on clean paper, and expose it to a gentle heat. If the oil be pure the whole will be evaporated, and no trace will remain on the paper; but if it has been mixed with a fixed oil a greasy spot remains behind.

*Test for Jelly.*—Let a grain of isinglass, glue, or any other gelatinous matter, be dissolved in a goblet full of water, and let a few drops of tincture of galls be added to the solution, the immediate product will be an abundant flocculent precipitate. This precipitate is a compound of the tan of the gall and the pure gelatine of the jelly.

---

*Armenian Cement.*—Soak isinglass in water till soft, then dissolve it in proof spirit; add a little galbanum, or gum ammoniac, and mix it with one-fourth the quantity of tincture of mastich. It must be kept well stopped, and when wanted liquefied, by the phial being immersed in hot water; used to cement jewels upon watch cases; also to mend china, or replace leaves torn out of books.

J. R. Watts.

A very pretty appearance may be produced by dissolving about fifty grains of lunar caustic in two ounces of water, and putting it into a glass with about 200 grains of mercury, the silver will shoot from the mercury in the form of a beautiful shrub.—*N. P.*

*A New Light.*—An ingenious chymist, in France, having found, after many experiments, that a void produced by electricity in a glass vessel became luminous, has, at last, succeeded in forming a long bottle, of 3 inches by 30, from which, having exhausted the air, and otherwise acted upon it by a galvanic battery. A light is now emitted, being hung up in his apartments, equally clear, but not so oppressive to the eyes as that of the Sun.—*Sunday Times.*

Digitized by Google

## QUERIES.

*To the Editor of the Penny Mechanic.*

Is the decomposition of water by a powerful galvanic battery effected rapidly, and what space would a cubic inch of water thus decomposed occupy?

B. G.

Might not the galvanic magnet be used to attract the particles of iron so injurious to the Sheffield workmen, and what is the inconvenience they complain of in the use of the machine for conveying away the particles by creating a draught of air?

B. G.

What is the principle of the solar microscope?

B. G.

## ANSWERS TO QUERIES.

*To the Editor of the Penny Mechanic.*

A strong solution of gum arabic in ink will, no doubt, answer, the purpose of W. J. The above is usually sold as Cordova lustre or ladies' blacking.

*Blacking.*—Ivory black, eight ounces; treacle, eight ounces; sweet oil, one ounce; sulphuric acid, once ounce; vinegar, one quart.

*Ink.*—Aleppo galls, eight ounces; logwood, four ounces; sulphate of iron, four ounces; gum arabic, three ounces; sulphate of copper, one ounce; sugar-candy, one ounce. Boil the gall and logwood together in one gallon and a half of water until one half of the liquid has evaporated. Strain the decoction, and add the other ingredients. Stir the mixture until the whole is dissolved, more especially the gum: then let it subside twenty-four hours, when it must be decanted and preserved in well-corked bottles. Ink powder is the deposit.

*Lamp Black Making.*—S. R. must make a chamber having a communication by its bottom or side with the flue of the fire, &c. The top of this chamber must be open and covered with canvass, which will permit the draught but retain the carbon, which is the article required.

*Steam Engine.*—If worked on one side of the piston there will be the same pressure on the piston but only half as often as if worked both sides; consequently, half the power only of a double engine, but at the same time only half the steam used.

D. D. THOMAS.

SIR,—I beg to inform "F. L. S." that the best and most economical, and by far the cheapest way of producing a polish on silver and plated goods is to observe the following directions:—Make a solution of strong soap and water, which must be hot, then by using a brush, clean that part which is wanted and polish with a bit of rag. The above will be found the best and quickest, as whiting and powder are apt to clog and are very difficult to remove. I am, Sir, yours, &c.

A. W. C.

SIR,—In answer to your correspondent "H," I beg to state that several of my friends have used Becam's arsenical soap, and have found it succeed better than any other preparation, and I do not think it so likely to injure the specimens as the solution of corrosive sublimate.

Yours, &c. J. R. W.

SIR,—In answer to your correspondent "N. P" as to the best place to make the opening for extracting the brains of birds, &c., I prefer the roof of the mouth; the inside of the skull should be afterwards washed with camphorated spirit of wine.

Yours, &c. J. R. W.

"Pickwick" will find his question respecting the solution of india rubber fully explained in No. 16, Vol. I.

"Hatine" had better purchase one of "Gould's Compound Microscopes." Mr. Carey, optician, of the Strand, is an excellent maker.

*Finsbury Mutual Instruction Society.*—Monday, Oct. 2. Mr. Thomas, on Railroads, at half past 8 o'clock.

## TO CORRESPONDENTS.

*Correspondents are in future requested to direct their Letters* "To the Editor, AT THE PRINTER'S, Holloway Press, Islington." *All communications to be Post Paid.*

*We have again to thank* D. Watts *for the articles sent.*

*The communication from* C. D. Thomas *shall be attended to. The "Drag" appears to be very well contrived.*

*A* Subscriber, *who asks a question regarding printing ink had better write again, and be more explicit in describing what he wants.*

*We have received a communication from* L. *accompanied by a model of his parachute. We fear, from the number we have already by us, that we shall not be able to find room for a description of it.*

Pickwick's *parachute has been received*

J. S., X., R. O.—*Their models and drawings of balloons and parachutes, as also the descriptions accompanying them, we acknowledge the receipt of.*

*If the Secretaries of the various Mechanics' Institutions will favour us with fresh lists of the forthcoming Lectures, we will insert them weekly as heretofore.*

*Received* M. Rough, J. F. M., J. A. I., Brack, *and several others.*

ERRATA.—In No. 47, page 56, eleventh line from bottom, for "28 *degrees* per inch," read 25 *pounds* per inch.

LONDON MECHANICS' INSTITUTION.—LECTURES.

J. HEMMING, Esq., on CHEMISTRY, September 8.

R. OGILVIE, Esq., on the NATURE and PROPERTIES of WATER, September 13, and on ELECTRICITY, September 29.

J. PEREIRA, Esq., on the SENSES, September 15 and 22.

S. W. BUTLER, Esq., on ELOCUTION and the DRAMA, Sept. 20 and 27.

T. CLAXTON, Esq., on PNEUMATICS, Oct. 4 and 11.

T. W. WOOLRYCH, Esq., on PRACTICAL EDUCATION, October 6.

B. R. HAYDON, Esq., on the HUMAN FIGURE and EXPRESSION, Oct. 13, 20, and 27.

Dr. BIRKBECK, on the MUSCLES and MUSCULAR MOTION, October 18, 25, and Nov. 1.

A. PEACOCK, Esq., on MENTAL ARITHMETIC, November 3.

Dr. TRUMAN, on RESPIRATION and the VOICE, November 8 and 15.

Colonel THOMPSON, on EMIGRATION, Nov. 10, and on the EFFECTS of MACHINERY, Nov. 17.

R. CHRISTIE, Esq., on NEW MECHANICAL INVENTIONS, Nov. 22.

G. FRANCIS, Esq., on CARICATURE DRAWING, November 24.

Subscription, 24s. yearly, or 6s. quarterly, with 2s. 6d. entrance. Tickets for the evening, 1s. each.

A Prospectus, giving full particulars, may be obtained at the Institution.

ANDREW M'FARLANE, Secretary.

No. 29, Southampton-buildings, Chancery-lane, September 7, 1837.

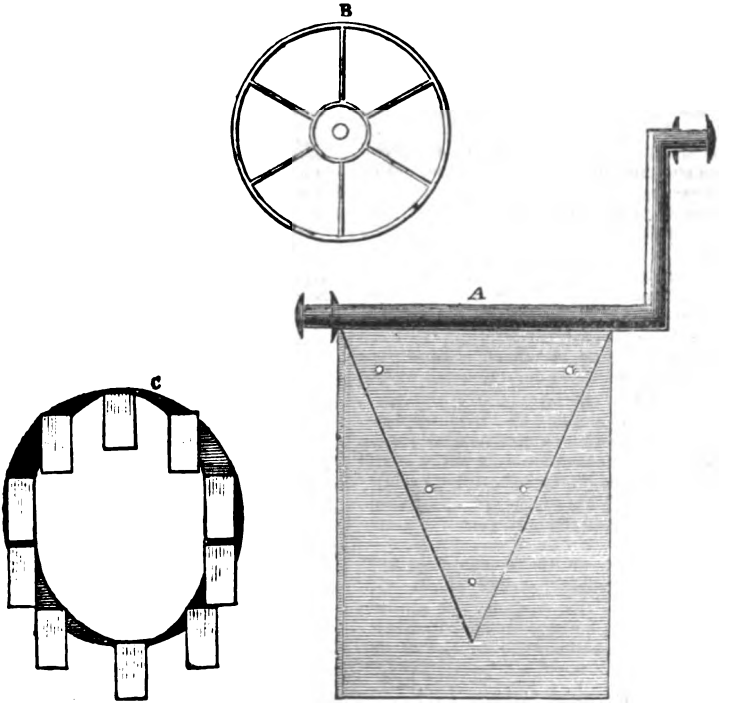
London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

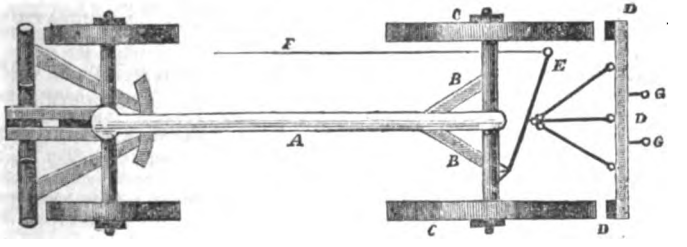
# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. L.] SATURDAY, OCTOBER 7, 1837. [Vol. II.


### UPRIGHT STEAM-BOAT PADDLE-WHEEL.




### COACH DRAG.





Vol. II.—No. L.

Holloway Press: D. A. Doudney.



Digitized by Google

## STEAM PADDLE-WHEEL.

*To the Editor of the Penny Mechanic.*

SIR,—If the description of an upright steam-boat paddle-wheel will be of any service to the numerous readers of your useful Magazine, it is at your service. I made one of the same description some time ago, and it fulfilled my expectations. I will explain one of 12 feet diameter in the wheel. The principle is the same as the wheel and axle in general use; the wheel to have a rim on it, to fix on the axle, 16 inches in diameter, to be fixed to the boat by iron bars; the paddle-wheel axle passing through this fixed axle 2 inches from the side, leaves 9 inches eccentric motion to the rim. The paddles are worked by cranks, each 9 inches in length, with 3 shoulders, one for each side of the wheel and one for the rim. The paddles set into the wheel on their respective cranks, and are secured in their proper positions by clasps or stays. When the wheel makes a revolution, each paddle keeps its proper position; and with 18 paddles on a 12-feet wheel, each dips 2 feet in the water under the rims of the wheel, and never rises above the rims, which entirely does away with the splash, or surge, the main object wished to be attained. The eccentric axle in the model I made was so placed that the paddles could be lifted out of the water although the wheel should be going round at the same time.

DESCRIPTION.—B the eccentric-wheel; C the paddle-wheel; A the shaft, with 9-inch crank.

I am yours, obediently,
A. HEWETT.

## COACH DRAG.

*To the Editor of the* PENNY MECHANIC.

SIR,—Thinking it may prove useful to your readers, I send you the following account of a coach drag. I have only observed two of them, one attached to a long stage, and the other to Stanbury's Dover van; which may be seen every Monday, Wednesday, and Friday, at the George Inn, Aldermanbury. It appears to be by far the best drag yet invented, and were it more known, would, I have no doubt, be much used. It will, from the engraving, be easily understood. Yours, &c.

C. D. THOMAS.

REFERENCES TO ENGRAVING.—A, the perch; B B, the hind axle; C C, the hind wheels; D D D, two shoes and connecting bar; F, the lever, its full fulcrum being on the hind axle; it is connected by the iron rods to the shoe-bar; at the extreme end is a chain, passing under and up the side of the van to the coachman's seat, where it is connected with a windlass; G G, iron rings in shoe-bar, by which it is suspended from the bottom of the van by means of two iron rods; F, chain leading to windlass. Now when the windlass winds up the chain the lever is pulled towards the hind axle, and carries with it the shoe-bar (with which it is connected by iron bars), and by that means presses the shoes against the tyres of the wheels, and so retards the motion of the carriage.

## MINERAL SPRINGS OF ICELAND.

"TOWARDS evening," says Krug von Nidder, "on the 7th August, I arrived at the Haukadal. Already, at a great distance, clouds of steam indicated the valley where these vast natural phenomena exist. My expectations were raised to the highest pitch, and the nearer I approached, the more slowly did the time seem to pass, until I actually reached the springs. At length I passed rapidly round a small rocky hill, which seemed torn asunder from the neighbouring mountains, and found myself suddenly in the midst of abundant columns of steam rising from the various openings; I hastened from one spring to another, till I stood at the head of the great Geyser, and saw down into its abyss. The spring was tranquil; but it excites the same feelings with which one walks on the crater of a volcano in a state of repose.

"After having in some measure satisfied my curiosity, I began to make the necessary preparations for passing the night. The horses were relieved of their burdens, and turned loose to search for forage in the grassy meadows of the valleys. I pitched my tent at a distance of about sixty paces from the great Geyser, in order to observe every movement. In the immediate vicinity there are some Icelandic huts, inhabited by the solitary family of a native. While I conversed on the subject of the Geyser with the proprietor, who was a very intelligent man, we heard a dull thunder-like noise under our feet, which soon became louder, and was changed to sounds resembling a series of shots, and following each other in rapid succession. The earth experienced a trembling movement; I hastened out of my tent and saw great masses of steam bursting from the interior of the Geyser, and the water of the spring thrown out to a height of fifteen or twenty feet. This agitation of the Geyser scarcely lasted a

Digitized by Google

minute, and the usual perfect tranquillity was then restored. I learned from the Icelanders that this outbreak of the Geyser was one of the frequent smaller eruptions, that those on a larger scale occurred only at intervals of from twenty-four to thirty hours."

"The Geyser has heaped up a flat cone of silecious tuffas and sinters, having a height of 25 or 30 feet, and a diameter of 200 feet. At the summit there is an almost round basin, at whose deepest point is the mouth of the funnel-shaped pipe of the spring. The basin measures at its edge 60 feet in diameter, and is 6 or 7 feet in depth. The pipe of the spring has, at its junction with the basin, a diameter of about 10 feet, but at the furthest point to which we can see, it contracts to about 7 or 8 feet. It descends quite perpendidularly to a depth of 70 feet.

"Two hours had elapsed since the first small eruption, and not the smallest activity was perceptible in the Geyser. The water filled about half the basin, and was perfectly still. Thin clouds of vapour only were formed on its surface. The thermometer, when placed in the water, indicated 72°. R. (194°. F.) and the temperature diminished as the evaporation proceeded. Suddenly I heard a dull sound like thunder under my feet, and immediately there followed five or six reports from beneath, during which the earth trembled. The water of the Geyser began to boil violently; the basin became filled to overflowing; large bubbles of steam broke forth from the funnel-shaped pipe, and threw the water, by several impulses, to a height of about 20 feet. Stillness was restored in a short time. I immediately examined the temperature of the water, and found that it had risen to the boiling point, but that immediately afterwards it sank imperceptibly."—*Edinburg New Philosophical Journal.*

## INSECTS FOR SPECIMENS.

THE hard-shelled winged insects should be pinned through the left wing, so that the pin may pass just under the first pair of feet. Other insects to be pinned through the thorax. As their feet generally fold under them, pin them at first upon a slice of cork, pull out the feet very carefully with a small pair of forceps, and fix them in a proper position with pins, for two or three days, after which they will retain their situation. If they are already stiff, breathing upon them for a few minutes will relax the muscles. For the sending of them to any distance, stick them in boxes about four inches deep, the top and bottom of which are lined with cork or soft wax, spread between paper, and about one-eighth of an inch thick, fixed to the box with glue and small tacks. Into each box put a small bag of powdered camphor, or a sponge impregnated with oil of cajeput, or any other strong-scented oil. The larger insects must not be put in these boxes with the small ones, lest they should get loose and break the others during the carriage.

Spiders are best kept in spirits of wine, by pinning them to a skewer of soft wood stuck into the cork of a wide-mouthed vial, so as to keep it in the middle; but if they are desired to be kept along with other insects in boxes or drawers, then procure a glass tube, seven or eight inches long, and three-fourths of an inch in diameter, open at both ends, with a cork fitted to one end; as also a splinter of wood, sharp at both ends, and so long that one end may be stuck into the cork and the other may reach to the middle of the tube. When you catch a spider pin it through the thorax, put the legs in the right position with pins, cut off the abdomen with scissors, and stick it in the splinter of wood; put it into the tube, and hold this over the flame of a candle, turning it constantly till the abdomen appears dry and round; then let it cool in the tube, and when cold cut it off and fasten it again to the thorax with gum-water, thickened with starch.

Caterpillars may be procured in a similar way, by being dried over the fire or candle in a tube, a slit being made, by which the inside may be pressed out, and the skin, by means of a blow-pipe, blown up to its proper size again.—J. R. WATTS.

## CHEAP AIR-PUMP.

GET a pair of bellows that are made with good leather and well nailed; undo a sufficient quantity of the nailing to enable you to fix an Indian-rubber strap tight across the valve, and then nail it up again. Into the pipe of the bellows put a valve, opening outwards; which may be made with a cork fitted tight into the pipe, with a small hole bored through it, and covered by a flap of cartridge paper and oiled silk, kept tight by an Indian-rubber string. Then fix this machine on a stand, with the valve-board free to move up and down. A bell-glass, resting on a piece of wet leather in the shape of the letter O, placed over the valve, will be exhausted by working the lower handle. B. G.

Digitized by Google

## PRODUCTION OF INSECTS FROM SILICA.

In our last vol., pp. 102 and 152, we have given an account of the experiments of the experiments of Mr. Crosse, by which it was asserted he had been able to produce insects in a very extraordinary manner from Silica, or flint. At the last meeting of the British Association for the Advancement of Science, Mr. Gray (in section D) offered some remarks on the supposed production of insects, by the experiments of Mr. Crosse, and referred to two experiments made by Mr. Children in a manner perfectly identical with those of the former. The solution of silica was obtained from Mr. Garden, in Oxford-street; and in one experiment it was sealed up, whilst in the other it was exposed to the air, but in neither case was there any appearance of insects. The insects had been very indefinitely described by Mr. Crosse, some having six and others eight legs. It was no proof that they could not have been produced from the water used in the experiment because it was boiled, as that would not be sufficient to destroy the eggs of the insects deposited therein.

The Rev. Mr. Hope remarked one peculiarity, that no one had given the insects a specific name, and that they merely appeared to belong to the commonest species of Acari.

The Chairman mentioned the circumstance, that the seeds and germs of animals and vegetables are earlier and more quickly developed in a current of electricity, and that in all probability these favourable circumstances operated upon the eggs of the insects produced in question. It was well known that seeds would retain their vitality for an indefinite period of time, and there was no reason why any limit should be put to the vitality of the eggs of animals.

Mr. Gray stated that prussic acid had lately been used for the purpose of destroying insects at the British Museum, particularly those infesting a mummy. Some of the larvæ of the common muscæ having been put into the acid, remained uninjured after two or three days' exposure.

Professor Graham remarked, that other plants and animals might be kept for an indefinite length of time, when the powers of time were either retained or suspended.

The Chairman observed that he had often dried to powder the eggs of various insects, which having been put into water were hatched.

Mr. Golding Bird afterwards referred to the observations of Mr Gray, with respect to the production of insects, as stated by Mr. Crosse in his experiments, which he had repeated on a large scale, but without any result, although he had continued them for some weeks, varying them in every possible form. He also explained that such could not have been produced from the silica, as this was precipitated from the mixture of the alkaline solution of silica and muriatic acid, the fluid passing through the filter being nothing but very dilute muriatic acid.

---

23a, Albemarle-street,
Sept. 25, 1837.

*To the Editor of the* PENNY MECHANIC.

SIR,—You will oblige me by inserting the following lines in your Magazine, and by that means, do what I hope you will consider only an act of justice under the circumstances, to Mr. Cowell :—

No feeling is, perhaps, more prevalent in a trading community than that of a dislike to monopoly, and in no way is this more strongly exhibited than in the opposition of various kinds which patent inventions meet with. No sooner is an useful apparatus patented than the inventive faculties of numbers who would never have benefited the public by their ideas, had not those ideas been suggested by an examination of the patent article, are immediately taxed to produce the same beneficial result without having recourse to the patent method. This feeling of opposition is even carried so far, that the most inefficient and clumsy methods of obtaining the same end, are caught at and published, apparently with no view but that of gratifying the spirit of opposition. I am led to make these remarks by the plans which have been made public in your Magazine, to supersede the invention lately patented by Mr. Cowell, for the removal of window-sashes.

Mr. Cowell deserves, and by means of some of the public press, has received the thanks of the public for his simple, neat, efficient, and cheap method of attaining this desirable end. He has brought out the article at a price evidently allowing only a fair tradesman's profit; and has thus, by its cheapness, put it within the power of all owners of houses to prevent the occurrence of accident on their property to the persons employed in the hitherto dangerous occupation of window cleaning.

But now the end is attained, others not satisfied that Mr. Cowell should enjoy his honours alone, are attempting to share them with him.

Digitized by Google

Why it is that these ingenious gentlemen did not communicate their ideas in time to prevent the necessity for Mr. Cowell's invention is a mystery, unless the reason be, either they had no ideas at all upon the subject previous to his being published, or that they did not deem them sufficiently perfect to merit publicity. And, after all, what are they? The plans detailed in Nos. 21 and 31 are evidently only make-shifts, both of which, I will venture to say, would be found more expensive in the end, and not half so convenient as Mr. Cowell's plan. And, as to the "Improved window-sash," described in No. 48, a very slight examination of it will convince any one that its expense will very considerably exceed that of a sash furnished with Mr. Cowell's suspenders. Besides, it is utterly inapplicable to old sashes, whereas Mr. Cowell's suspenders are as easily adapted to old as to new sashes.

I myself had in use a plan for detaching my windows from the lines previous to Mr. Cowell's patent, which answered very well, and was by far more simple than either of the plans referred to above; but I should have been ashamed to publish it after, and in opposition to the patent one, and have now some of my windows fitted up with Mr. Cowell's suspenders, which answer perfectly well.

With common care my sashes (which are very large ones) are taken out without danger; and as to loss of time, one minute is sufficient to remove the largest sash. In conclusion, allow me to say, that I cannot but admire the spirit of impartiality which has induced you to insert the various methods in your Magazine, but am persuaded that their publication will result in favour of Mr. Cowell, as a careful examination of all must lead to the conclusion, that, for the purpose it is intended to answer, his plan is so perfect as apparently to defy competition. I am, Sir, yours, J. F. Myers.

*To the Editor of the Penny Mechanic.*

Sir,—Every sensible man must, I think, agree with J. F. S. in his observations upon the lamentable distress of the hand-loom weavers. The delusion which induces men to choose, either for themselves or their children, an avocation so deplorable, and so utterly hopeless, is to me inconceivable. Little, indeed, is to be expected from Legislators, where their own especial security or aggrandizement is not at stake; the only boon that commerce has to crave from this source is that they would condescend to withhold their unwelcome meddling altogether, and levy their tribute upon those who can afford to pay it.—With respect to emigration, I must confess I do not clearly see how our unfortunate countrymen are to improve their condition by that means; the distress at Lyons, in point of numbers, has lately been even greater than with us; the use of machinery is increasing in all countries as well as in England; and it would be as vain to attempt to arrest the progress of that great source of national prosperity, as it would be to prevent the use of gunpowder in the art of international slaughter. When the produce of a country exceeds its consumption, a manifest advantage is gained over those with which it trades; the result is not altered by the nature of the material exported; the great object of obtaining the means of comfort and well-being, for the mass, can only be accomplished by the importation of value from foreign countries: this value is the same, whether it be paid for by the produce of the land, or of labour; and although every individual cannot enjoy the fruits of national prosperity, still that enjoyment is brought nearer to him, and he is enabled to possess it with less exertion than would be required without the influx of foreign value. This reflection should stimulate every needy man into action; let him look around at the busy world, all striving to increase their share of the national wealth, let him choose one of the innumerable avenues best suited to his capacity, and struggle onward with the crowd,—"Aide toi, et le cirl t' aidera,"—Help yourself, and depend upon it, it is the only assistance which can be of *permanent* benefit to you. Yes, Mr. Editor, men should render themselves capable of instructing their children in the rudiments of education, and instill into their minds, those sentiments of honour which will incline them to become good and useful citizens; this is often the only means they can afford of fulfilling the most imgortant duty they owe to their children and to society; for we have, in fact, no national provision for education. The great universities are inaccessible even to most of the middle classes; and many of the more opulent send their boys to college rather with the view of obtaining an aristocratical distinction than for the advantage of any real knowledge they acquire. Education in these schools is too much mixed up with the thirty-nine articles, and far too circumscribed in its object: they make good Greek and Latin scholars, which is the only advantage

Digitized by Google

worthy of notice derived from an university education by the greater number of students. Modern languages, and the most useful arts and accomplishments are not taught at all; and the vicious habits of debauchery and immorality which are usually contracted there, more than counterbalance the effect of any virtue that may be contained in the sainted amulet of orthodoxy.

Many institutions and considerable property have been destined for public instruction, but they have fallen into the hands of unfaithful stewards. If you wish to send a child to one of these schools, you must first solicit a list of the persons to whom your birthright has been bartered, and then, if you happen to be the best bidder, your child is admitted into the *charitable* establishment. As for parish schools, they are indeed a miserable resource: every thing that can be devised to degrade these poor children is resorted to; they are continually paraded about in public places, that every one may witness their humiliation; they are dressed in conspicuous and ridiculous liveries, in order to cut them off from all superior society; and to blight every germ of honourable and dignified feeling, they must be stigmatised with a badge and numbered like the wretched exiles of Siberia. And why is the instruction of the people so neglected, or, rather, so studiously withheld? We are not, I hope, to be told, that it is on account of the expense; while we are supporting a church establishment which costs more than would be required for rational, useful, and universal education. I offer no opinion upon the advantages which result from religious instruction; for it is scarcely possible to make two observations upon the subject without offending some sect or other.

The real object of men in power, however, is, to keep the people in a state of poverty and ignorance, in order to profit by the helplessness of the one, and the imbecility which results from the other. I do not allude to any individual men or government: it is with few or no exceptions, the tendency of all governments, at all times. Therefore in this, as in every thing else, men must provide for themselves, or they will surely be abandoned, even by those whose especial duty it is to protect them. Much might be said upon this subject, but I am fearful of defeating my own object, by encroaching too far upon the columns of a work which I esteem as eminently useful and laudable in its object, and which will doubtless prove equally beneficial in its effect.

I remain, &c. Q. E. D.

## CHEAP ELECTRICAL MACHINES.

*To the Editor of the* PENNY MECHANIC.

SIR,—In the Chemist (1823-4) is the following cheap and simple way of making a plate machine:—Take a circular piece of wood about one inch thick, and of convenient diameter, and paste over it a sheet of brown paper, cutting the edges even; then paste a strip all round the edge of the circle, and when quite dry paste on another coating of the brown paper in the same manner; then cut a square hole in the centre and pass through it the axle, which mount on pillars as usual; then cut a piece of wood, staple shape, and cover it with woollen cloth for the rubber. A cylindrical piece of wood with rounded ends, covered with tin-foil, and mounted on a wine-bottle, serves for the conductor; three wires being inserted in the wood to collect the electricity from the two sides and edge of the wheel. A wine-bottle with about three inches of iron-turnings or filings in it, and filled to the shoulder with water, and coated on the outside with tin-foil, and having a wire passed through its cork, one end reaching the filings and the other surmounted by a ball, will perform the office of a Leyden vial, and obviate the necessity of coating it inside, a work of great trouble and tediousness. Yours, &c.

C. D. THOMAS.

## STEAM ENGINE CRANKS.

SIR,—In your first Vol. p. 273, "T. M." says, that the full power of the crank of a single engine is not more than one-third its revolution, and the power of double engines with two cranks at right angles does not exceed two-thirds the revolution, and asks the question as to what power engine exerting its force throughout its revolution is equal to two fifty-horse engines with ordinary cranks. Now, if "T. M." by the above, means that there is no gain by using right-angled cranks, then thirty-three and one-third is the power required. If, however, he means that each of the single engines (working right-angled cranks) has full power two-thirds of the revolution, and that the power of the pair of engines is double that quantity, then sixty-six and two-thirds is the power required. C. D. THOMAS.

*Soft Metal.*—Bismath tin and regulus of antimony, of each a pound, melted together, used for taking impressions of medals or coins. J. R. W.

Digitized by Google

# THE CHEMIST.

*Ethereal Oil of Wine.*—It is well known that a mixture of alcohol and water in the same proportions as they exist in wine, has scarcely any odour, whilst a few drops of wine remaining in a bottle will be easily recognised by its smell. This characteristic odour, which is possessed by all wines in a greater or less degree, is produced by a peculiar substance, which has all the characteristics of an essential oil. This substance is not to be confounded with the aroma of wine, for it is not volatile, and appears to be different in various kinds of wine, and in the greater number it does not exist at all. When large quantities of wine are submitted to distillation, an oily substance is obtained towards the end of the operation; it is also procured from wine lees, and especially from that which is deposited in the casks after fermentation has commenced. This ethereal oil forms about one-forty thousand part of wine in its original state. It has a strong flavour, is usually colourless, but owing to the presence of a small portion of oxide of copper it is sometimes greenish; when this is separated by hydro-sulphuric acid it is colourless. The mode of purifying this substance, and full particulars respecting it will be found in the "London and Edinburgh Philosophical Magazine," for 1837. This ethereal oil contains a considerable quantity of oxygen, but its constitution is very different from that of the oxygenated essential oils hitherto known. It consists of a peculiar acid, analogous to the fatty acids, combined with ether, and, of course, is one of the class of compound ethers. It is the first instance of the occurrence of an ether which is insoluble in water, and produced during the vinous fermentation without the intervention of the chemist. To the new acid MM. Diebig and Pelouse have given the name of ænanthic acid, and to the essential oil ænanthic ether.

*Shell Gold.*—Mash by grinding the cuttings of gold leaf with thick gum-water and spreading the ground gold in pond-muscle shells. Shell silver is prepared in the same manner, using silver leaf instead of gold.

*Artificial Gold.*—Copper sixteen ounces, platina seven ounces, zinc one ounce. Melt together.

*Powder Gold.*—Verdigris eight ounces, tully four ounces, borax and nitre of each two ounces, corrosive sublimate two drachms, made into a paste with oil and melted together. Used in japan work as a gold colour.

*Patent Yellow.*—Common salt one hundred weight, litharge four hundred weight, ground together with water kept for some time in a gentle heat, water being added to supply the loss by evaporation, the whole is then washed with more water, and the white residium heated till it acquires a fine yellow colour. Used as a paint instead of King's yellow: is not so bright, but does not injure the health of the painters so much as that poisonous colour.

*French Polish.*—Shellac three ounces, gum mastich one ounce, sandarach one ounce, spirits of wine forty ounces, dissolve in a gentle heat, making up the loss by evaporation.

*Refined Ox Gall.*—Fresh ox gall one pound; boil, skim, add one ounce of alum, and keep it on the fire for some time; to another pint add common salt one ounce in the same manner; keep them bottled up for three months, then decant off the clear, mix them in equal proportions, a thick yellow coagulum is immediately formed, leaving the refined gall clear and colourless.

*White Hart Varnish.*—Gum mastich four ounces, gum juniper, venice turpentine, of each three ounces, pounded glass (to prevent the gums from forming an impenetrable mass) four ounces, spirits of wine two pints, used upon cards, sheaths, &c.

*Indian Steel Wootz.*—A kind of steel which retains its edge when ground for a long time; it has been made by first melting highly carburetted steel with alumine, by which a white brittle alloy was produced, sixty-seven grains of which remilled with five hundred grains of good steel produced a metal perfectly similar to wootz in perfection of edge; damask by spirits of vitriol.

*Argentine Steel.*—By melting five hundred parts of steel with one of silver produces a description of steel far superior to that of the best common sort.

*Amalgam of Zinc.*—To two ounces of zinc heated in a crucible add five ounces of quicksilver also heated. Used to spread upon the rubbers of electrical machines.

*White Copper—Britannia Metal.*—Copper from forty to fifty pounds, white arsenic ten pounds, oil a sufficient quantity to make the latter into a paste, melted together. Used as an imitation of silver.

J. R. W.

Digitized by Google

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—I should be glad to know whether there is any substance which when spread upon paper, will prevent the least particle of printer's ink attaching itself to it. I remain, your obedient servant, A SUBSCRIBER.

SIR,—Can any of your numerous readers inform me what those small balloons, called pilots, which ascend from Vauxhall Gardens, &c., are made of? By inserting this you will oblige JOHANNES.

SIR,—Perhaps some one of your correspondents would state, through the medium of your excellent Magazine, in what manner the nautilus and other sea shells are polished. Yours, &c. W. H. S.

SIR,—In olden time it was very difficult to obtain a receipt which would be of particular advantage to any one; however, times are strangely altered, for I perceive many very valuable "secrets" made known to the public in the columns of your undeniably cheap, useful, and highly-interesting Publication. Perhaps some of your intelligent readers will communicate how a cheap (as it is for private use) washable varnish for shop-window tickets might be conveniently made. Also, how grease spots and dried paint might be removed from woollen cloth apparel (of various colours) without leaving a mark where such remedy has been applied; and also, the method of grinding glass. In so doing you will much oblige JAMES.

SIR,—I should feel obliged by being informed what quantity of atmospheric air is consumed by a mould candle, of six to the pound, in one pound? i.e. how many gallons or square feet. I remain, Sir, yours respectfully, A. B.

SIR,—I am anxious to ascertain the simplest method of extracting the saccharine matter from mangel wurzel, or beet root, and in what proportion it is produced. Perhaps some of your intelligent correspondents, who have experimented upon this vegetable, will be kind enough to inform me, through the medium I have here adopted. By inserting this you much oblige G.

## ANSWERS TO QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—As "B. G." wishes to know what space a cubic foot of water, decomposed by galvanism, will occupy, I beg to inform him, that when decomposed it will occupy 1,987 cubic inches, which consists of 1,325 of hydrogen, and 662 of oxygen. During the decomposition, by means of an ordinary galvanic trough, though the bubbles of gas succeed each other quickly, it would take some time to decompose any considerable quantity.

The principle of the solar microscope consists in a hole being made in the shutter of a darkened room; into which hole is screwed a tube, having at its extremity one of Wilson's microscopes attached. The rays of the sun are thrown into the hole by means of a plane mirror, which is supported outside the shutter by hinges, and can be arranged in such a manner that the rays of the sun may be reflected through the tube to the object under examination. CHINA.

*Blackman's Oil Colour Cakes.*—Grind the colours first with oil of turpentine, and a varnish made of gum mastich in powder, four ounces dissolved, without heat, in a pint of oil of turpentine; let them dry; then heat a grindstone by putting a charcoal fire under it; grind the colours upon it, and add an ointment made by adding melted spermaceti, three pounds to a pint of poppy oil; take a piece of the proper size, make it into a ball, put this into a mould and press it. When these cakes are used, rub them down with poppy oil, oil of turpentine, or any convenient vehicle

J. R. W.

SIR,—In answer to the query of "G. D S." in the 48th No. of your valuable Magazine, I beg to inform him, that he must get his leaves when green, and keep them in a book for a month or so till quite dry; then place them upon the edge of a new book, and tap them with a clothes-brush till the other parts give way and leave the specimen required. F. A. L.

*To Silver Copper.*—Take a small quantity of pure silver and pour over it twice its weight of nitric acid, and twice as much water as acid. The silver will be quickly dissolved. The solution, if the metal and acid be both pure, will be transparent and colourless. Then precipitate the silver by the immersion of polished plates of copper. Take of the silver twenty grains, cream of tartar two drachms, of common salt two drachms, and of alum half a drachm, mix the whole well together. Take then the article to be silvered, clean it well, and rub some of the mixture, previously a little moistened, upon its surface. The silvered surface may be polished with a piece of soft leather. The dial-plates of clocks, scales of barometers, &c. are all plated thus. J. R. W.

"Alexir."—The balloon must be filled with pure hydrogen gas; made by pouring water on sulphuric acid (oil of vitriol) and iron filings, placed in a bottle, in the neck of which must be inserted a cork, with a hole in it to admit of a tobacco-pipe. When the effervescence or decomposition of the water takes place, the filings imbibe the oxygen and the hydrogen flies off, which will escape through the pipe into the balloon, if fastened on to it.

## TO CORRESPONDENTS.

*Correspondents are in future requested to direct their Letters* "To the Editor, AT THE PRINTER'S, Holloway Press, Islington." *All communications to be Post Paid.*

*We have received a severe castigatory letter from Mr. Rough, in which he accuses us of having first called upon the mechanics of this country for support, and after having, by that means, fully established our publication, (f then selling ourselves to monopolizing companies, and excluding the correspondence of our former supporters. But there is a strange anomaly in one part of Mr. Rough's letter, where he says,* "*A daily penny work would not be more than sufficient to do justice to my plans.*" *From this passage we might naturally be led to infer, that Mr. Rough himself wishes to become the monopolizing, or forestalling party. We have never received a single farthing from any one for the insertion of any communication since the commencement of the publication. But we put it to the good sense of our readers to say, whether we do or do not devote a* greater proportion *of our columns to the insertion of correspondence than any other publication of the day. We are well satisfied that they will give us full credit when we assert, that it has ever been our study to act with fairness and impartiality to the whole of our Correspondents*

J. F. S.—*His article on* "*Steam Navigation*" *in India has been received.*

*We will endeavour to find room for* W. Syrett's *watch alarum shortly.*

Alpha.—*The first division of the British Cyclopedia will suit him best. Secondly, The Wonders of the Telescope. A cleverly-written little work published by Darton and Clark, Holborn-hill. Price* 2*s.* 6*d.*

A. S. *can obtain all that he requires of Mr. Portwine, Medical Bookseller, Aldersgate-street.*

*Received* Johannes, *and* W. Burbridge's *letter on the parachute.*

Q. E. D. *on the Study of Mechanics, and* Alexir *next week.*

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

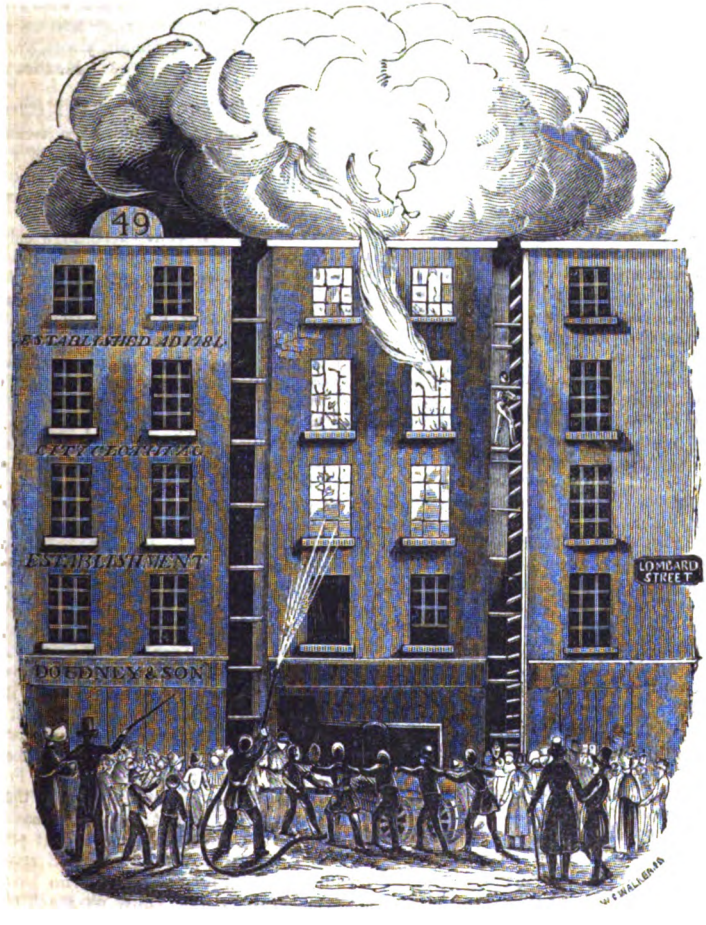
Digitized by Google

# THE PENNY MECHANIC,

## AND THE CHEMIST.

No. LI.] SATURDAY, OCTOBER 14, 1837. [Vol. II.

PLUMMER'S PLAN FOR A FIRE STAIRCASE.




Vol. II. - No. LI. Holloway Press: D. A. Doudney.

Digitized by Google

## FIRE STAIRCASE.

SIR,—As on a former occasion (in Numbers 4 and 38) you gave insertion to the descriptions of a plan proposed by me for Rescuing Drowning Persons from the Ice, I have taken the liberty of sending you a drawing and description of a Fire Staircase.

I am aware that some of the most ingenious men of this country have invented machinery which would generally succeed in cases of fire, could they be brought to the spot immediately. But, unfortunately they cannot be; as the late melancholy loss of life at the fire in the Strand fully proves.

My plan is to have a staircase fitted in the party-wall of a house, as seen in the Engraving. There is to be an indention made between two houses, adjoining each other, to reach from the pavement to the parapet; this indention to be about two feet in depth, and eighteen inches in breadth: by making it thus narrow it will allow nervous persons to descend with greater ease and safety, as, when the feet are placed on the steps of the staircase, the back will be supported by the wall behind them. For the purpose of preventing any one falling sideways into the street, and also of taking off what might be considered by some an unsightly appearance in the house, occasioned by the indention, a handsome scroll of iron work might be carried up the front of it.

On every floor of a house there is to be a strong door, which, for security against fire or thieves, may be covered with sheet iron. This door is to be fastened in the simplest manner possible (by no means to have a lock, as in the moment of danger the key might not be at hand); two strong bolts would be quite sufficient, which any one, with the least presence of mind would be able to draw back. On this door being opened, a safe, easy, and certain means of escape would present itself in the Fire Staircase; it being fitted up in the party-wall directly opposite the door. Each house is to be fitted up with a Fire Staircase on one side, for the benefit of its neighbouring house, and fire doors on the other, as the means of escape for its own inmates.

I have asked the opinion of several persons in the building line, and have been informed by them that houses can be altered and fitted up with the Fire Staircase without endangering their safety.

But admitting that this cannot be done in old houses, there is nothing to prevent its being accomplished in new buildings. How many hundreds of persons are there who nightly go to their beds with the horrors of fire preying on their minds; while, were this plan adopted in their houses, they might repose in tranquillity.

I am convinced, sir, that were any speculative builder to erect a number of houses, fitted up with the Fire Staircase, he would not long want tenants. I have sketched off the house which is given in a wrapper to one of your Monthly Parts, on account of its height, and also on account of the narrowness of the street (Lombard-street), which is always a great obstacle to the rendering assistance in cases of fire. I remain yours, &c.

H. PLUMMER.

---

*To the Editor of the* PENNY MECHANIC.

SIR,—For an inexperienced advocate to enter the lists as the antagonist of a professed student would at once be considered a temerity; and in the following remarks, doubtless, something of that kind may be traced. Although only an occasional reader of your publication, I have always entertained a respect for it (if I may be allowed the term), grounded upon the perfect equanimity of temper which your able correspondents have displayed. This opinion I have maintained until reading your number for this day (Number 49), and more particularly the article signed "Q. E. D;" which, although displaying sound sense, is in many parts written in too pompous a style to be easily digested by every one into whose hands it may fall. After commencing with the modest request of "two or three columns by way of introduction," he passes on to—"I beg to assure them that I do so without the slightest feeling of ill-nature," &c.; and then (oh! admirable consistency) talks about their "foolish and puerile vanity." To "Q. E. D." this may not be ill-nature, but allow me to ask him, is it respectful? or is it not vanity, the foundation both of that and his French quotation of "Du choc des opinions nait la verite?" Could the major part of your readers revel in French folios, and talk French as fast as the Parisians, there might be some reason in introducing these phrases, but at present our hypercritical friend should recollect he is writing for the many, who have not seen France, and know as much of the language as a bull does of geography, and among which number I class myself. The ungenerous fling at Sir A. Agnew would have been much better omitted; for however misled he may have been, no person can deny but that his motives were good.

Digitized by Google

Had he, instead of his name, introduced that of the greatest humbug of the age, D. O'Connell, he would have done much better: but, foregoing all politics, allow me to proceed a little further. Although your correspondent seems heartily tired of the parachute designs which you have published, sneeringly referring to "pictures," he is himself adding to the list, by one design published and another promised; but to his published plan several disadvantages may be stated; the first is the expense, which would be considerable every descent; the next is that it would not be sufficiently capacious to allow of a safe descent, should any large quantity of ballast be taken up. As to its portability, allow me to suggest to "Q. E. D." that he should fasten it to a carriage, which might ascend with it, and upon its descent only have to hook on a horse, and he might instantly ride home in a new-fashioned phæton. Various opinions have been expressed upon Mr. Cocking's parachute; but, in my opinion, that of Mr. Green is entitled to as much, or more, than any of the theoretical aeronauts. He says, "My opinion was, that having resisted the pressure of the air in its ascent, the parachute would descend safely." Whose judgment can be entitled to so much attention as that of our ethereal voyager? and add to his that of Mr. Monck Mason, whose scientific essay proved, or attempted to prove, that Mr. C. could not descend safely. The fact unfortunately verified his prediction; but the query may be asked with propriety, to what may this effect be attributed? Let it be remembered that Mr. C.'s parachute was not constructed of sufficient strength, a tin tube being decidedly too light for the heavy pressure upon it, particularly when, as in the present case, it was broken, and merely joined together with packthread. Take these things into consideration, and then say whether the principle or the mode of practice is most to blame. I have by me a design of a parachute, but at the present I defer sending it, until I see the wonder-working aboriginal idea of "Q. E. D."

Begging insertion of this hasty sketch,
I remain, sir, your obedient servant,
*Sept.* 30, 1837. ALEXIS.

[This letter was *marked* "post paid," but *we* had to pay the postage.]

It is intended shortly to open eight miles more of the London and Birmingham Railway.

## ON THE STUDY OF MECHANICS.

NO. I.

"Etiamsi omnes, ego non."

THE science of mechanics is beyond comparison the most important branch of human knowledge; and it becomes a subject of intense interest in the present age, which is so remarkable for improvement, that the sciences and arts may be said to progress *à vue d'œil.* Almost all the immense advantages which we possess over the ancients are derived from our superior knowledge in mechanics: steam-engines, horology, and even printing, are all comparatively of recent origin. Horology is still far from its zenith; and we have good reason to expect still mightier achievements from the agency of steam.

Some attribute considerable mechanical knowledge to the ancients, seeing the stupendous works they have accomplished, the great weights they have moved, &c.; but the simplest elements of the science will suffice to enable any person of ordinary capacity to construct machines for such purposes. Indeed, any one acquainted with the leading principles of mechanics, can easily calculate the effect of any simple mechanical machine; but without that knowledge, if he should be afflicted with that reckless propensity for construction, which is sometimes the effect of uncultivated genius, but more frequently a mere morbid hallucination, he will be exposed to endless vexation and disappointment, and not unfrequently to ultimate ruin; although a small portion of the time he expends in laborious and expensive experiments, if devoted to legitimate study, would enable him to perceive in an instant the result which he obtains by tedious and expensive operations. Unfortunately, unlearned men are often like mutilated animals, unconscious of their loss. To such as these I must say, that their enthusiasm and vanity, or even natural talent, can never supply the place of the accumulated experience of past centuries; and the mass of information collected in the works of those great men who have appeared at various periods, shining as blazing beacons on the rocks of science. They are groping in the dark, like the foolish virgins, who provided no oil for their lamps; they are exulting in the discovery of some A, B, C, and evident principle, or wasting their energy in visionary pursuits, and filling their closets with skeletons of the deformed abortions of their incubus imagination.

Digitized by Google

Many, I believe, are alarmed at the formidable aspect of science, with its algebra, trigonometry, and other contingent auxiliaries; and they are told that "a little learning is a dangerous thing;" but let them remember that the person who made this remark possessed no learning at all except that which belonged to his own speciality, and assisted his natural aptness for the contemptible art of making rhymes.

"Nisi utile est quod facimus stulta est gloria."

I believe Mr. Pope's only motive for using this expression was, that he could find nothing better to rhyme with "spring." A little learning is a very useful and valuable thing; it not only gives its possessor a knowledge of things with which he would otherwise be unacquainted, but it gives him the desire and facility of acquiring more. Therefore I advise every one who takes any interest in matters of science, to go steadily to work, and study the object of his pursuit; let him have different books upon the same subject; and if one be obscure upon any particular point, he can refer for elucidation to another. Read every thing with caution and suspicion; for you will find but few books upon any subject which do not contain a multitude of lies. The capacity of the human mind varies in different individuals, from the deep ocean to a puddle; yet there is an autophanous principle, more or less developed in every mind; cherish this faculty, by constantly endeavouring to think for yourself, for it is the germ of genius.

It is doubtless a very troublesome habit for one who possesses only an imperfect knowledge of a subject, to cavil at every thing which does not happen to suit his fancy or prejudice; but notwithstanding this inconvenience, I should by no means recommend any person to place implicit confidence in the opinions or assertions of any writer whatever. Written laws may indeed be considered as infallible authority, because however bad they may be, they are still "*Dura lex sed lex;*" but if we take the writings of any author as a test of truth, we are liable to be led into innumerable errors, not only relating to the fastidious science of mathematics, but in every branch of human knowledge.

Let any tolerable linguist read Johnson's Dictionary attentively: he will find that the errors it contains are neither few nor trivial; they are not accidental mistakes occasioned by inattention, but the consequence of opaque spots on the Doctor's mind.

Rousseau wrote upon music, the subject of his especial study. He says, when two sounds nearly approach to unison, a pulsation or beating is heard, which becomes faster and faster, as the sounds approximate to unison. On this circumstance he builds a new and, I hope, his *manes* will pardon me for adding, excessively absurd theory of harmony. Now it is known to every one who ever tuned a musical instrument, that the vibrating becomes slower, instead of faster, as the sounds approach the unison.

Sir I. Newton's calculations about the heat of the sun compared with red-hot iron, and the resemblance between the prismatic spectrum and the diatonic division of a vibrating string, &c. require no comments; but Dr. Simson detected a wrong definition relating to solids in Euclid. I must stop here, or I shall be enticed into the dominions of still mightier prejudice.

These are but a few instances promiscuously taken; but if we examine the whole range of literature, ancient and modern, we shall find the same stamp of erring humanity impressed even on those productions which are the greatest pride and glory of man.

Let this teach us to examine an assertion with the utmost care before we adopt it as a positive truth, and, above all, let it be an antidote to presumption in the expression of our opinions before their truth is thoroughly demonstrated. Q. E. D.

*To the Editor of the* PENNY MECHANIC.

SIR,—That giant power, steam, not content with extending its benign influence over all Europe, appears to be advancing with rapid strides over the vast continent of Asia. Along the mighty rivers of that quarter of the globe, by the aid of this monster, the merchandise of England is conveyed with the same ease and expedition as in England itself. What Britons can read the following extract without a feeling of pride and exultation at the striking picture it pourtrays of the genius and enterprize of his countrymen!

"RIVER STEAMERS.—The success which has hitherto attended the attempt to establish steam-vessels on our rivers has exceeded the most sanguine expectations. These vessels which, at the outset, were employed simply for the convenience of passengers, and in conveying goods for personal consumption, have now, from the regularity, speed, and ease which they combine, secured a large share of commercial patronage. No

Digitized by Google

higher proof of their popularity, perhaps, can be given than the fact that the natives who manifest so strong an aversion for everything new, are become eager to employ them in the transportation of their merchandise. It is not, we hear, an unusual occurrence for native merchants to purchase large consignments of British goods in the go-downs of the consignee, and to leave an order for their being conveyed at once to the steamer, to be transported to Mirzapore and other stations. The mercantile freight of the steamers has, in fact, increased to such a degree as to render it difficult to squeeze in a package of any other description, and the agent runs the risk on every despatch of displeasing more individuals than he is able to gratify. Hence, it has become apparent that our present complement of steamers is totally inadequate to the increasing wants of the country; and we hear, with much pleasure, that the Government have indented on England for another supply of vessels greatly exceeding the last in number. But the new steamers will scarcely be found sufficient to supply the growing demand.

* * * * *

The multiplication of steam-vessels on our navigable rivers is, in fact, multiplying the means of defence. If twenty steamers were constantly available in this country, Government would possess facilities for the rapid transportation of troops and military stores from province to province, by which the security of the empire would be indefinitely increased. In the case of steam-vessels, there is this recommendation over military roads,—that the latter can only be kept up at the expense of the State, while the former are maintained at the charge of the community."—(Quoted in a monthly publication from the *Friend to India*, a Calcutta paper.)

"But the new steamers will scarcely be found sufficient, &c." What will those who lament over the loss of "the good old times" say to this? I am, Sir, yours, greatly obliged, J. F. S.

---

*Esteemed Friend Editor,*

THE high opinion I entertain of the utility of thy book induces me to intrude upon the attention of thy readers, while I offer a few observations upon the complaints of thy correspondent, "Rough." Education and constant example have taught me to consider peace and kindly feeling, amongst men, as the only condition upon which we can secure contentment and happiness. This sentiment I wish to impress upon the mind of thy friend, "Rough." I do not question his praiseworthy motives, but I am convinced he is mistaken in the object of his zeal; and moreover, he appears to have written under the influence of considerable wrath, which is the scourge of mankind, and the implacable enemy of truth and justice. If I understand his meaning rightly, it is this: when he says, "thou art sold to monopolizing companies," he is speaking in parable; he means that thou hast advocated the cause of those great enterprises which give our country pre-eminence over all the commercial nations of the world; and that thou hast not encouraged the working men in unlawful combinations, which only tend to undermine the national wealth and credit, and sadly increase the misery of the evil doers themselves. Allow me to call the attention of friend "Rough" to a statement made by a person, named Ashworth, at the late meeting of the British Association, at Liverpool. At a "strike" which took place at Preston some time ago, 8,500 persons were thrown out of employment; of these 150 were taken before the magistrates, charged with drunkenness and disorderly conduct; 75 were committed for assaults and intimidation of workmen; 20 young females became prostitutes; 3 persons died of starvation, and 5,000 suffered extreme privation until they returned to their occupations. The total loss to the community was estimated at 107,206*l*. These are poor deluded men, who, though highly blameable, are nevertheless much to be pitied; but he who possesses knowledge, and knowingly excites the spirit of evil, is not a deluded, but a wicked man.

Friend Editor, I am satisfied that the greater portion of the many thousands who read thy book, applaud the impartial and benevolent spirit in which it is conducted; and I trust friend "Rough" will, upon maturer consideration, acknowledge that it is better to propagate useful knowledge than to sow the seeds of discord. Um ——— m,

Q. E. SMOOTH.

---

*To the Editor of the Penny Mechanic.*

SIR,—Number 47 of the PENNY MECHANIC contains several descriptions of parachutes that either have been, or may be constructed. The one contrived by Mr. B. Wilson I desire, by your permission, to make a few remarks upon, having myself made two models for parachutes, and, I think, well considered the nature of ex-

Digitized by Google

periments of this kind. With respect to Mr. Wilson's contrivance, I wish not to detract from the credit due to him for the ingenuity of his plan, but its great weight is indeed a weighty objection to all parties engaged in the ascent or descent. There is no balloon now in use, except the great Nassau, capable of ascending with and separating so great a weight from it in the atmosphere; taking also a sufficient quantity of ballast for the safety of those in the balloon; and this is a most important part of the business, for should such an experiment be made with a balloon having only power to raise the parachute, it would be almost certain death to the aeronauts. The balloon ascending to an immense height after separation, you are compelled to part with a great quantity of gas, which is your buoyant power, and having lost that, you require a large quantity of ballast to ease your own descent.

If the gentleman you alluded to should be induced to make a trial of Mr. Wilson's parachute, I hope he will take care to have it well tried (and I am sure the inventor will desire this too) before he risks his life in it.

I am, sir, Yours respectfully, H.

## MISCELLANIES.

*To the Editor of the* PENNY MECHANIC.

THE following curious experiment may prove interesting to some of your readers. Sling a shilling at the end of a piece of thread, by means of a loop; then, resting the elbow upon a table, hold the other end of the thread betwixt the forefinger and thumb, observing to let it pass across the ball of the thumb; and thus suspend the shilling in an empty goblet. Observe, the hand must be perfectly steady, and if you find it difficult to keep it in an immovable posture it is useless to attempt the experiment. Premising that the shilling is properly suspended, you will find that when it has recovered its equilibrium, it will, for a few moments, remain stationary; after which it will, of its own accord, and without the least agency from the person holding it, assume the action of a pendulum, vibrating from side to side of the glass, and after a few seconds, will strike the hour nearest to the time of day; for instance, if the time be 25 minutes past 6 it will strike 6; but if 35 minutes past 6 it will strike 7; and so on of any other hour. It is necessary to observe, that the thread should lie precisely over the pulse of the thumb; and this may in some measure account for its vibration, but the cause of its striking the precise hour remains unexplored; for it is no less astonishing than true, that when it has struck the proper number and its vibration ceases, it acquires a kind of rotary motion, and at last becomes stationary, as before. A. W. C.

*To form Artificial Musk.*—The mode of making artificial musk, which is used in Germany, is as follows:—Add to one drachm of oil of amber, by small portions at a time, four times the quantity of nitrous acid, carefully stirring it the whole time with a glass rod, and continue this till the whole be converted into a yellow resin, possessing the smell of musk. It must be kept closely stopped up like real musk, and may sometimes supply the place of that high-priced article; not forgetting the nature of its cheap ingredients. H. W. S.

*Instantaneous production of Curds and Whey from Milk.*—A very ready and elegant mode of procuring curds, and also a pleasant acidulous whey, is, by adding to a glassful of milk a little solution of citric acid, taking care not to add too much; an experiment or two will readily show the quantity necessary to effect the purpose.

*Formation of the Silver Tree, or Arbor Dianæ.*—Mix one part of a saturated solution of nitrate of silver with twenty parts of distilled water, and pour the mixture upon two parts of mercury in a phial. After some time (the phial being left standing quietly) the branches and a figure of a tree formed of brilliant silver, will appear to grow from the mercury in a very beautiful manner. Rationale: the silver in solution is robbed of its oxygen by the metallic mercury, and is then consequently precipitated.

*Formation of the Iron Tree, or Arbor Martis.*—Add a saturated solution of subcarbonate of potass to a solution of nitrate of iron. The mixture swells up considerably, then sinks to rest, and metallic branches spring out in a very curious manner on the surface of the glass.

*Lemonade.*—Mix one part of citric acid with six parts of finely-pounded loaf sugar. A very fine dry lemonade is thus prepared, which may be preserved for any length of time. The quantity of this mixture necessary to be put into a glass of water, to make pleasant drink, must be regulated by the taste of the person using it. J. R. WATTS.

Digitized by Google

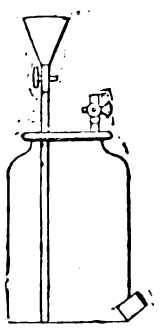
# THE CHEMIST.

*To the Editor of the* PENNY MECHANIC.

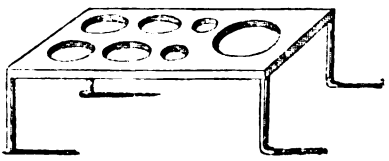
SIR,—Nothing affords a stronger proof of the increasing and very praiseworthy taste for scientific pursuits among juvenile students of philosophy, than the inquiries and the sensible instructions that have often followed the inquiries, in your excellent Magazine for constructing *home-made apparatus* for performing experiments and verifying scientific truths. We have the authority of one of the greatest chemists of a by-gone age (Sir H. Davy), that one experiment, well performed, does more to fix a fact in the memory than pages of mere theory; and in confirmation of this, his pupil (the illustrious Faraday) in his work on "Chemical Manipulation," (a book no young chemist should be without) has signally illustrated the simplicity of apparatus and the abundance of expedients to which the students may have recourse at very small expense, but with ample satisfaction to himself. In pursuance, then, of these ideas, I propose, from time to time, to offer to the notice of your correspondents such plans for simplifying expensive apparatus as I have myself adopted, with the earnest hope that their feasibility and efficiency may inspire new Tyros in science, to continue these sort of communications.

I am, sir, yours, &c.,

BRACK.

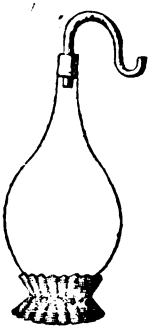


The above engraving represents a gas-holder, made of an earthen jar, holding about a gallon, the bung of which is fixed in, air-tight, with beeswax and resin cement; a tube, to which is attached a stop-cock and funnel, goes through it down to the bottom, and a ⅜-in. brass stop-cock is also fixed by the side of it, by means of a thin washer (a halfpenny will answer very well), screwed on the lower side of the bung; at the bottom of the jar is a small tin tube, with a brass screwed into it, such as the common tin lamps are provided with, to pour in the oil. This is the whole apparatus. An aperture is easily made in the jar, if the glazing be first filed off, and the cement will make it tight. To use the gas-holder, first fill it with water completely, through the funnel, keeping, of course, the stop-cock open to allow the air to escape; then, when closed, the lower screw can be taken off without the water escaping; into this introduce the beak of the retort, or the end of the tube attached to the matrass in which the gas is made; the gas bubbles up, and displacing the water, which runs out at the same opening, occupies its place. When the water has sunk to the level of the tube screw in the plug, and when required, force out the gas through the stop-cock, by pouring water into the funnel; and as the end of the tube is under water in the jar, of course no gas can escape through it. Or, if you have a tube with a ⅜-in. screw at the end (the size of the gas-burner screw), you can, by just loosening the lower plug, force the gas in through it; and by screwing a gas burner on you can burn the gas through it. Or, if you have oxygen gas, you can use it as a blowpipe, with one of small bore fixed to it; or show the combustion of charcoal on it. In fact the student can soon apply it to all his purposes.



The engraving above represents a lamp stand, made of a plate of sheet iron, eight or ten inches long, pierced with holes of different sizes, and rivetted to four iron legs; it is also to be fitted with brass sliding rings. The retort, &c., is placed on the hole that suits it, and a lamp placed beneath: glass capsules, or filtering funnels, can also be supported by it. The student must of course make it for himself. A lamp can be made out of a large glass inkstand, with a hole bored through the cork by means of a hot iron, and a piece of tube, or part of an old pencil-case, fitted in it; then cut a notch in the cork to admit air, and cover the surface with sealingwax: oil as well as spirits will burn in it.

Digitized by Google



This is a Florence oil-flask; it must be washed out with potass and water, and fitted with a cork and bent tube of glass or of block tin; it will serve a multitude of purposes, as it will bear the direct heat of a lamp. Some of the rush envelope must be twisted into a circular ring to stand it upon, particularly when hot.

BRACK.

*The Rein-Deer.*—The trot of the rein-deer is about ten miles an hour; and their power of endurance is such, that journeys of 150 miles in 19 hours are not uncommon. There is a portrait of a rein-deer in the palace of Drotningholm (Sweden), which is represented, upon a case of emergency, to have drawn an officer with important dispatches the incredible distance of 800 English miles in 48 hours. This event is stated to have happened in 1699; and the tradition adds, that the deer dropped down lifeless upon his arrival. Pictet, a French astronomer, who visited the northern parts of Lapland in 1769, for the purpose of observing the transit of Venus, was anxious to know the speed of the rein-deer; and therefore started three rein-deer in light sledges, for a certain short distance, which he accurately measured. The following was the result:—The first deer performed 3089 feet 8 inches in two minutes, being at the rate of nearly 19 English miles in an hour, and thus accomplishing 25 feet 8 inches, in every second. The second did the same in 3 minutes and 26 seconds. The ground in this race was nearly level. The rein-deer requires considerable training to prepare him for sledge travelling; and he always demands an experienced driver. If the animal is not well broken-in he is unmanageable; and if the driver is inexpert, the deer has sagacity enough to turn round and rid himself of him by the most furious assaults.

**We understand, from a morning paper, that Mr. Green is making preparations for an aerial voyage to Scotland.**

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—I should feel much obliged if some of your readers could inform me how the "Instantaneous Light Apparatus" can be made. I believe it is sold by the name of the "Hydrogen Instantaneous Light." Yours, &c., J. W. E.

A Subscriber would feel obliged to any of our readers who could inform him of the best work on the Principles of Mechanics; also the best edition on Practical Engineering.

SIR,—Can any of your intelligent correspondents inform me how to proceed in bending, sealing, and enlarging a glass tube, over a lamp, for chemical experiments; and whether the pincers, &c., ought to be made hot? as I find, on twisting the end of a tube, for the purpose of sealing, that the part touched by the cold pincers becomes vey brittle.

Yours, &c., H T.

SIR,—I should feel obliged if any of your correspondents would inform me of the best method of making magnets. A. T. R.

## ANSWERS TO QUERIES.

"James." The term of two, four, or six months, is the time required for the patent to remain open to objections; at the end of which period it is sealed.

## TO CORRESPONDENTS.

*Correspondents are in future requested to direct their Letters* "To the Editor, AT THE PRINTER'S, Holloway Press, Islington." *All communications to be Post Paid.*

*The communication from* C. D. Thomas *shall be inserted in a week or two.*

*We have again to thank* D. Watts *for the papers he has sent us.*

*We have to acknowledge the receipt of* H.'s *communication on gothic and elliptical arches. We are sorry he did not reduce his drawing to the size of our front page, as the whole of the work is to be gone over again, for which our engraver makes a considerable advance in his charge.*

J. G.'s *Curious Chemical Experiment shall be inserted shortly.*

*We have to apologise to* Geo. P. Payne, *for not inserting his description of a Self-moving Machine; the reason is the copy has been mislaid. If he will send us another it shall be attended to.*

Syret—Ardens—Burne, *and several other of our Correspondents' drawings are at the engraver's.*

*We intend shortly to devote our front page to the different plans of Parachutes in our possession.*

ERRATUM.—In our last Number, page 80, in the second line under the head "Answers to Queries," our compositor substituted the word "*foot*" for *inch*.

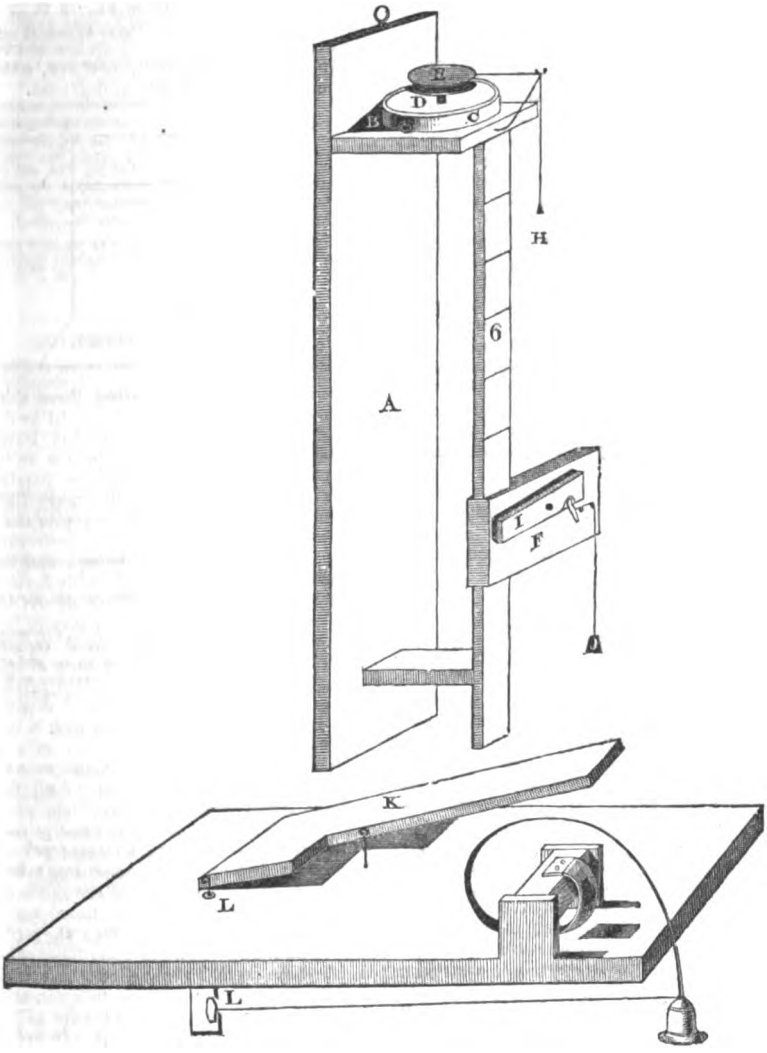
London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LII.] SATURDAY, OCTOBER 21, 1837. [Vol. II.

### WATCH ALARUM.




Vol. II.—No. LII. Holloway Press: D. A. Doudney.

Digitized by Google

## WATCH ALARUM.

*To the Editor of the* PENNY MECHANIC.

SIR,—As a plan for a Watch Alarum may prove acceptable to some of the readers of your valuable and interesting Magazine, I indulge the hope that you will find a place for the following. I have tried and found it to answer well. The works of a watch cannot possibly be injured, and it may be made by any one who can use a knife. I am yours, &c.

SYRET.

A is a piece of wood 14 inches long and 2½ wide; B a shelf 2½ inches square, on which is fixed a pasteboard case C, lined with wool, to hold the watch D; E a small grooved wheel, with a key fixed in the centre, the key to be put in the watch as in winding up; F a piece sliding on the lath G; a thread is put round the wheel F, fixed to the weight H; the weight and wheel should be of equal weight, and need not, together, exceed three quarters of an ounce.

It will be readily seen that when the weight H descends to the lever I, the weight J will be disengaged, and falling on a trap may be made to release a bell.

A scale being formed of the lath G, by marking the distance the weight descends hourly, the bell may be made to ring with great exactness by means of the sliding piece.

A plan has been shown in your journal for releasing a bell, but I think the annexed better. The weight J falling on the lever K, draws up the wire L, and sets the bell free.

## ON THE STUDY OF MECHANICS.

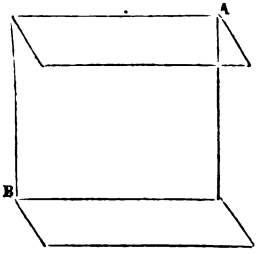
NO. II.

DURING the reign of Louis XVIII. and Charles X. of France, it was as great a crime to make, or even to possess, any figure representing Napoleon, or his son (who was called by the Imperialists Napoleon II.), as it is now to make the likeness of his quasi Majesty, Henry of Bordeaux.

Some time before the revolution of 1830, an ingenious French artist, in order to avoid persecution, contrived a view of the tomb at St. Helena, in which the foliage of the trees was made to form, in an open space between them, a striking portrait of the Emperor Napoleon. It was so skilfully executed, that hundreds of persons might examine the engraving without discovering the secret, even when told to search for it; but being once perceived, the whole attention is absorbed by the gigantic spectre, frowning with the sullen pride of fallen majesty.

This is the picture of human science; the common observer sees every step, every expression, supported by the most minute and cogent reasoning; and he readily admits that all is accurately proved, and universally true; but a more penetrating mind, sees error stalking like a phantom, in the midst of proofs and demonstrations, as if in very mockery of human reason.

Another example will, perhaps, make my meaning more clearly understood.




Here is a figure representing three sides of a cube, or solid square, placed like the cover of a thick book, with the leaves taken out; conceive the side A B to lie flat on the paper, and the two parallel sides to project from it; no more lines are employed than are necessary to trace the boundaries of each side. Now conceive the side A B to be *raised*, and the opposite edges of the parallel side to coincide with the paper; another figure, totally different in position, is formed by the same lines, and the mind cannot, without effort, pass from the idea of one to the other. This is an emblem of one of the most abundant sources of dissention amongst mankind—ambiguity.

When we commence the study of any science, it is of the utmost importance to understand the exact import of all the various terms employed in it: definitions must be accurately and universally true, or they are worse than useless; yet we frequently find erroneous definitions taken as axioms, and considerable errors occur in the calculations which are based upon them. Indeed, if we judge from the writings of numerous authors upon these subjects, they seem to have two principal objects in view,—to propagate error, and to render their subject as obscure as its natural simplicity will permit. In order to accomplish this, tedious and puerile arguments are adduced in support of evi-

Digitized by Google

dent and uncontested truths, which so bewilder the student, that he is led to believe that there is some real difficulty which he cannot understand; while the more important subjects, which require the clearest explanation and the deepest thought to be properly understood, are expressed in vague, ambiguous, and inaccurate terms; and rendered unintelligible to a great number of readers, by an unnecessary parade of technical erudition.

Penetrated with the importance and difficulty of the task I am about to undertake, I shall now endeavour to establish accurate definitions relating to the science of mechanics. I shall take the Cambridge school as the standard of received doctrines, and explain my reason for differing therefrom upon some particular points. Perfect accuracy is my aim, but not my pretension. I shall not attempt to decorate Truth with the ornaments of erudition, but show her in that simple and modest attire, in which she most delights.

Q. E. D.

## SCIENTIFIC QUESTIONS.

The following questions, relating to several distinct branches of science, are intended as mental exercise. They are so arranged, as gradually to increase in difficulty from the first to the last; and any person may test his own ability by solving them. I do not consider any of them very difficult, and they all admit of positive and incontrovertible answers. Something of this kind, on a more extensive scale, would I think, be useful, by bringing the reasoning faculty into action; for this reason, I have endeavoured to introduce such questions as are not likely to accrue in the ordinary routine of study. They must not be considered as answered unless a satisfactory demonstration is given.

1. What is the difference between *half-past six o'clock in the evening*, and 6h. 30m. P. M.?
2. Is the flame of a candle translucid? that is, does it admit the free passage of rays proceeding from other luminous bodies?
3. When a solid sphere revolves about an axis passing through its centre of gravity, does the centre of gravity revolve?
4. An inflexible vessel, six inches in height, being filled, contains fifty cubic feet of water; let this vessel be placed with its base parallel to the horizon, and closed in every part except a small hole in the top, into which a common quill is fitted, projecting two inches above the surface of the water. When this quill is fitted, how much will the pressure on the bottom of the vessel be increased?
5. Can a man see his own face?
6. Does the moon revolve about its axis?
7. Let a rope be passed over a vertical pulley, and two weights of 50lb. be attached, one to each end of the rope; what is the tension of the rope on the top of the pulley?
8. What is the latitude and longitude of that place where the wind, if any, is always due north?
9. It is stated in a foolish work recently published, that if there were no atmosphere, a person turning his back to the sun would be in total darkness: prove this to be false.
10. What is the difference between the dominant of the relative minor and the relative minor of the dominant?
11. Does the barometer indicate the *density* of the air?
12. The sun, moon, and stars are visible before they are really above the horizon: does the same effect take place when the mast of a distant ship is seen at sea?
13. Prove that æroliths are not projected from the moon, as supposed by some mistaken philosophers.
14. Describe the force which impels a balloon upwards.
15. What is the difference between a major and minor semitone?
16. How must a spring or straight lever be formed, so that when a force, acting at right angles, is applied to the extremity, the resistance at every part will be proportional to the pressure?
17. Suppose a perfect telescope of sufficient power could be constructed, and an object in the moon of the size of a man, sufficiently illuminated to render it visible all that distance, why would it still be impossible for us to see it?
18. How many perfect consonant intervals are there in an untempered diatonic octave, including the two tonics?
19. By what means can a man alter the motion of the centre of the earth?
20. If a particle of matter, weighing one grain, move with a velocity of six feet per second, what force would be required to stop it *instantaneously*? Q.E.D.

## THE POLYTECHNIC UNIVERSITY.

We feel great pleasure in laying before our readers the following prospectus of this Institution, which, if carried out to the full extent of its projector's wishes,

Digitized by Google

will be of incalculable advantage to the rising generation.

To the Promoters of Education.—Having been for near fifty years a warm advocate for the doctrine,—that it is the duty of society to provide for the placing of each individual human being, on his entrance into active life, in a condition to take a useful and a comfortable standing among his fellow men; and, therefore, that each child, whether of rich or of poor parents, ought to be trained up into habits of useful industry, as well as of study;—my mind is confirmed in the opinion that every school ought to be a manufactory, and every manufactory a school.

Near forty years ago, in the hope of setting an example, and of proving the utility and practicability of uniting study with as much useful manual labour as would keep the body in health, I took a workshop adjoining an academy at Bristol, in Pennsylvania, in the United States of North America, and undertook, for a moderate remuneration, to instruct any of the students, a few hours each day, in the practical use of the tools employed in various kinds of manufactures.

The advantages of the plan were soon apparent, and several boys acquired a considerable share of mechanical skill; but the ill health of the principal of the academy occasioned the breaking up of the establishment.

Other engagements prevented my making a second attempt; but I have ever since, on all convenient occasions, laboured to show the necessity of the universal establishment of Manual Labour Schools, in which mental and physical instruction should go hand in hand, and thus the health of both body and mind be provided for.

I have critically investigated the state of education in America, in France, Belgium, Holland, and Germany, and conceive that I have accumulated a mass of information which might, under proper management, prove eminently beneficial to the human family.

I am, therefore, anxious to see the commencement of an institution to which I might commit the results of my long observation of human nature, and my study of its capabilities; and also, of my experience as a cultivator of land, as a teacher, and as an engineer; in order that those results may be sifted, the chaff blown away, and the good seed sown in good ground, to the end that the rising generation may reap a plentiful harvest of the means of contemporaneously educating the physical, the intellectual, and the moral powers of man, together with the inculcation of the only true religion—the love of God and neighbour—to the utter exclusion of the dogmatic spirit of sectarianism; that so, the professors of every Christian creed, who cherish the spirit of mutual forbearance and universal charity, may unite in supporting a rational and comprehensive system of education.

It gives me great delight to hear that Manual Labour Schools are now flourishing in America, and that their good effects are widely manifesting themselves; and I feel that I ought no longer to delay a project which has been maturing itself in my mind for many years.

I therefore propose,

1st. That a Joint Stock Company be formed for the purpose of founding and conducting a Sample School, to be called the Polytechnic University, No. 1 for 2000 students, who shall be alternately engaged in physical and in intellectual occupation, so proportioned, that the health, both of body and mind, may be eminently promoted, and every student sent out into the world, grounded, to the extent of his capacity, in science and literature, and practically instructed and exercised in agriculture, arts, and manufactures, so that he may be qualified to take a useful standing in society, either in the ranks of science, literature, legislation, agriculture, the arts, manufactures, or commerce, as circumstances, may favour; being also rendered superior to adversity, by having the power of following the progress of improvement, and of finding employment as a teacher in Manual Labour Schools, or in other educational institutions; or, as a manager or superior workman, in some of the many new businesses which that progress must, in the nature of things, be continually setting up.

2nd. That the capital of the Company be £200,000., to be raised in 10,000 shares of £20 each.

3rd. That 1000 acres of land be purchased as near London as can be obtained for the price set down in the estimate, and that buildings be erected thereon, suitable for dwellings, schools, lecture-rooms, workshops, barns, &c.

4th. That when the arrangements are completed, the students be employed according to the following Table of Study, Labour, and Amusement; subject to be varied by the Directors:—

A. M. 6 to 8. Working in the fields, gardens, manufactories, or stores.

Digitized by Google

A.M. 8 to 10. Washing the person, breakfast, and amusement.
10 to 12. Study.
12 to 2. Dinner and amusement.
P.M. 2 to 4. Study.
4 to 6. Labour.
6 to 10. Washing the person, tea or supper, and amusement.
10 to 6, A. M. Sleep.

Working 4 hours—study 4 hours—meals and amusement, 8 hours—sleep 8 hours.

5th. That, as few will be found to advocate a system of education without devotional exercise, and, as offence ought not to be offered against sectarian prejudices, it is expedient that the devotional exercises be conducted in the words of Scripture alone, without note or comment; by which procedure the knotty question will be solved, of how to hold religious worship, free from the dominion of that hydra-headed monster, sectarianism, under which the Christian world has so long been enslaved: that, for this purpose, the Lord's prayer, without addition, be repeated morning and evening throughout the week; and, that a liturgy be used on Sundays, consisting of confession, prayer, and praise, selected from the Scriptures, thus enabling Christians of all denominations to unite in one common address to the throne of mercy.

6th. That sermons, not exceeding fifteen minutes in the delivery, consisting of preceptive passages of Scripture, without the addition of any human composition, be delivered on Sundays, leaving the pupils free to form their own doctrinal systems, or to join any existing confession, when they arrive at years of discretion.

7th. That, as soon as 1000 shares are subscribed for, a meeting of the subscribers shall be called, to appoint directors and other officers, to determine the amount of deposits, and periods of calls; to direct legal provision to be made for securing the shareholders from all liabilities beyond the amount subscribed for, and to take such other measures for promoting the undertaking as the majority of the meeting may deem needful.

*Estimates.—Outlay of Capital.*

| | |
|---|---|
| 1000 acres of land (sandy or other soils) fit for spade husbandry ..... | £50,000 |
| Stock ..... | 10,000 |
| Buildings ..... | 80,000 |
| Furniture ..... | 10,000 |
| Tools ..... | 10,000 |
| Philosophical apparatus, &c. .. | 10,000 |
| Library ..... | 10,000 |
| Incidentals ..... | 20,000 |
| | £200,000 |

*Annual Income.*

2000 pupils, at £25 each ..... £50,000

*Annual Expenditure.*

Beyond the proceeds of the sales of the surplus produce of the land and manufactures.....£20,000

*Annual Profit,*

Being 15 per cent. on the capital £30,000

JOHN ISAAC HAWKINS,
Civil Engineer.

## LONDON AND BIRMINGHAM RAILWAY.

THIS splendid undertaking has now been completed as far as Penley, near Tring, in Hertfordshire; and on Saturday last, the Directors, accompanied by a party of their friends, made an experimental excursion to that station, preparatory to the portion of the railroad, which is nearly finished, being opened to the public on the following Monday. Penley, the village to which the railroad is completed, is 31½ miles from London, and less than two miles from Tring. The train started from Euston-grove at precisely seven minutes before nine o'clock, and arrived at the station at Boxmoor at nine minutes before ten. The train here entered on to the new line of rails. Immediately after leaving the Boxmoor station there is an embankment of very considerable length and height, at the conclusion of which there is a short cutting of a few feet in depth, and a tunnel. The tunnel is only 300 yards in length, and the inconvenience which has been complained of in passing through those at the earlier part of the railway, in the want of light, therefore, was scarcely felt. An arrangement has also now been made with a view to remedy this defect entirely, by the introduction of lamps into each carriage. At Beakhampstead a new station has been built in the Elizabethan style of architecture, which forms an agreeable relief to those at the other stations, the whole of which are mere plain brick or stone erections. The train passed this station at ten o'clock precisely, and concluded its journey down without any accident or mistake, by arriving at Penley at ten minutes past ten, thus having performed the whole distance from Primrose-hill in an hour and eleven minutes. The line of rails now laid down does not extend more than a hundred yards beyond the station, and

Digitized by Google

concludes there in a deep cutting about fifty-five feet below the level of the earth, in a soil consisting entirely of chalk. The spot at which this excavation is made is the highest point of the whole line of railway from London to Birmingham, and its level is 300 feet higher than that of the station at Euston-square; a gentle acclivity, therefore, extending throughout the whole distance. The country in the neighbourhood is beautiful in the extreme, and the village of Aldbury on the one side, and the town of Tring on the other, are seen to great advantage from the adjacent rising grounds.

The passengers re-entered the carriages at about twenty-six minutes to twelve o'clock, and started off to London; but owing to some unforeseen interruptions on the road, which were attributed to the circumstance of the train not being expected, they did not reach town before about twenty minutes to two o'clock. The delays were principally caused by trains of carriages, containing earth, being on the line of rail on which the train was running. On reaching Euston-grove, the whole of the passengers expressed themselves highly gratified with their trip, which, from the delightful country through which they passed, was certainly one calculated to excite their admiration.

## PLEASING OPTICAL EXPERIMENTS.

*To the Editor of the* PENNY MECHANIC.

SIR,—Having recently made some very interesting optical experiments, I thought that a description of a few of them would not prove unacceptable to many of your readers. I have therefore taken the liberty of forwarding you the following:—

1st. If a soap-bubble be blown up, and set under a glass, so that the motion of the air may not affect it, as the water glides down the sides, and the top grows thinner, several colours will successively appear at the top, and spread themselves from thence in rings down the sides of the bubble, till they vanish in the same order in which they appeared. At length a black spot appears at the top, and spreads till the bubble bursts.

This black spot was considered by Sir Isaac Newton to be the thinnest substance he ever observed; and yet it is capable of reflecting a faint image of a candle or the sun. Sir Isaac says it is not more than the 750,000th part of an inch in thickness.

2nd. If a piece of plain polished glass be placed upon the object-glass of a telescope, and the interval between them be filled up with water, as the glasses are pressed together, the same colours arise at the point of contact, and spread themselves in circular rings round that point in the same order as in the soap-bubble.

3rd. A convex and concave lens, of nearly the same curvature, being pressed closely together, exhibit rings of colour about the points where they touch. Between the colours there are dark rings, and when the glasses are very much compressed the central spot is black.

4th. Two pieces of plate glass, wiped clean, and rubbed together, will soon adhere with considerable force, and exhibit various changes of colour. Yours, &c.

*Fleet Street.* J. G.

## MISCELLANIES.

*Cheap Filtering Machine.*—Get a large flower-pot, and put a piece of sponge on the hole; then fill three-fourths of the pot with clean sand and charcoal, the charcoal to be broken into small pieces the size of pease; then put a piece of linen on the top and tie it round the sides; after which pour the water to be cleansed into the basin formed by the linen, and it will pass through the hole at the bottom quite clear, although it were ever so muddy when put in. ALPHA.

*American Expresses.*—The rapidity with which the government express was carried with the President's message to all the chief cities in the Union deserves a record. That to Philadelphia and New York is unparallelled, perhaps, in the history of the world. The express left Washington at 12 o'clock on Tuesday, reached Philadelphia (145 miles) at 6; and New York (242 miles), at 3 minutes before 11: thus performing the whole distance in 10 hours and 57 minutes. 74 miles of railroad, between Baltimore and Wilmington, were travelled in 1 hour and 55 minutes.

*Ink for Printing on Linen with Types.*—Dissolve one part of asphaltum in four parts of oil of turpentine, and add lamp-black or black-lead, in fine powder, in sufficient quantity to render the ink of a proper consistence for printing with types.

*Curious method of catching Wolves.*—Amongst the modes of catching or destroying them, practised by rude nations, Pennant mentions that the Tartars take them by the help of a large hawk, called berkut, which is trained to attack them, and will fasten their head, and deliberately tear out their eyes.

Digitized by Google

# THE CHEMIST.

## CHEMICAL TESTS, OR RE-AGENTS.

CHEMICAL analysis consists of a great variety of operations, performed for the purpose of separating the component parts of bodies. It might seem an impossible task to exhibit, in a separate state, five or six substances, the weight of some of which is, perhaps, less than the one five-hundredth part of the whole; yet to so wondrous a degree of perfection has the science of chemistry arrived, that we are enabled to do this with ease.

When in an analytical pursuit the object of inquiry is—What are the elementary parts of a certain compound?—we place that compound, under particular circumstances, to the action of certain bodies, or powers, which it is expected will chemically act upon it; and which, when they do produce changes so obvious to the senses as to enable us to decide whether the compound does or does not contain the principles which it was suspected to contain. The bodies which produce these changes are called tests, or re-agents, the proper application of which constitutes the chief part of the proceedings called chemical analysis.

To illustrate the agencies of chemical re-agents, I shall subjoin some striking and beautiful experiments; but first it will be necessary to describe the most important tests individually.

*Tincture of Litmus—Preparation.*—Tie bruised litmus root in a linen rag, and steep it in pure water. Strain the infusion, and to keep it from spoiling add to it an eighth part of alcohol. Should the tincture be more of a purple colour than of a blue, it must have a drop or two of liquid ammonia added to it. *Use.*—It is a test of most uncombined acids. Its blue colour is changed to red by water containing 1-20,000th of its bulk of sulphuric acid. The redness produced by carbonic acid and sulphuretted hydrogen gas goes away when the mixture is heated. The other acids permanently redden the test; the red colour is changed to blue by the alkalies and alkaline earths.

*Tincture of Turmeric* is prepared in the same manner as tincture of litmus. It has a fine yellow colour, which alkalies change to a reddish brown. The carbonated earths have no action upon it, so that in solution they may be thus distinguished from alkalies. It is a delicate test, being affected by a solution containing only 1-2000th of potass. Turmeric test-papers are prepared as litmus test-papers are.

*Tincture of Galls* is prepared by steeping bruised nut-galls in boiling water, filtering the solution, and adding to it an eighth part of alcohol. It is the test generally employed for detecting iron, with all the combinations of which it produces a black tinge. It is likewise, owing to the *tan* contained in it, a good test for gelatin, with which it forms an insoluble precipitate.

*Sulphuric Acid.*—1. Discovers, by a slight effervescence, the presence of carbonic acid. 2. Barytes, for which it is the best test, is precipitated instantly in the form of a white powder, which is a sulphate of barytes. 3. It throws down lime from most of its solutions. 4. It precipitates lead as a white powder.

*Oxalic Acid* (in solution) is a most delicate test of lime, which it separates from all its combinations.

*Oxalate of Ammonia* (which may be easily formed by saturating the carbonate of ammonia with a solution of oxalic acid) is preferable to the pure acid, as a re-agent, being less affected by other substances.

*Pure Alkalies* and *Carbonate of Alkalies* (in solution) precipitate most of the earths and all the metals; the colour and other properties of the precipitate determining the nature of it.

*Lime Water*, made by dissolving pure lime in rain-water, is chiefly used as a test for carbonic acid, with which it forms a white precipitate. On the same principle liquid carbonic acid is a test for lime. Lime-water also shows the presence of corrosive sublimate, by a sediment of a brick-dust colour.

*Barytic Water* is more effectual than lime-water in denoting carbonic acid, and is more portable and convenient; since, from the pure earth, the solution may be at any time readily prepared. The barytic solution is also a most sensible test for sulphuric acid, which it indicates by an insoluble precipitate.

*Metals* may be used as tests of each other, on the principle of elective affinity. Thus, for example, a polished iron plate, immersed in a solution of sulphate of copper, soon acquires a coat of this metal. This is occasioned by the sulphuric acid seizing on the iron, and letting fall the copper; and the same in other instances.

*Nitrate of Silver* (in solution) is peculiarly adapted to the discovery of muriatic acid and muriates. For the silver

Digitized by Google

combines with the muriatic acid and forms a flaky precipitate, which at first is white, but on exposure to the sun's light, acquires a blueish, and finally a black colour. Muriatic acid consequently is a test for silver.

*Acetate of Lead* (in solution) is a test for sulphuretted hydrogen, which occasions a precipitate of a black colour. It also forms a white precipitate with sulphuric acid; for which, however, it is not so good a test as the following.

*Muriate of Barytes* (in solution) is the best test for sulphuric acid. A sensible precipitate is produced by it in water containing only 1-910,256th part of sulphuric acid. This is supposing the acid to be uncombined; for if the acid be in a state of combination (as in sulphate of soda, &c.) the test is not so sensible.

*Prussiate of Potass* is a very sensible test of iron; with the solution of which, in acid, it produces a Prussian blue precipitate. To render its effects certain, a little muriatic acid must be added previously, to saturate bodies which might interfere. J. R. WATTS, M.D.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Can you or any of the numerous readers of your valuable little work, inform me, where I can purchase a cast-iron bottle, or one that mercury is imported in; with the price. Also where I can purchase an iron tube, to fit into the bottle, and also the price; being for the purpose of making gas. A YOUNG CHEMIST.

SIR,—Can you or any of your very numerous Correspondents inform me how the gold leaf is laid on glass to make it look so smooth? Also how to remove spots and rust from polished steel without injuring the polish? Could Mr. Watts inform me the shape the wires should be made for supporting birds, &c.; also, whether the flesh of the wing and leg should be extracted or not, and wires placed in them?

Yours, &c., W. H. P.

SIR,—Why are conical wheels more generally used (for vehicles) than cylindrical ones? The mode of constructing night glasses, such as are used at sea; the method of drilling and rivetting glass and china; Also the manner in which engravers blacken the letters or figures on brass or copper plates.

R. W.

SIR,—I shall feel obliged if any of your Correspondents will inform me how to decide on the quality of steel when manufactured into cutlery.

A YOUNG TRADESMAN.

SIR,—I should feel much obliged if any of the numerous readers of your truly useful publication could inform me what are the requisite ingredients to clean old pictures without injury to the paint; and if there is any preparation that will improve the appearance of old gilt frames. Yours, &c.,

RENOVATOR.

SIR,—I should feel obliged if any of the Correspondents of your invaluable work would inform me of the best method of polishing marbles, more particularly Egyptian green. I am, &c.,

E. F. D.

## ANSWERS TO QUERIES.

SIR,—Your Correspondent Johannes wishes to know what the pilot balloons at Vauxhall Gardens are composed of. I have much pleasure in informing him that some are made of oiled silk, and others of prepared turkey's maw. A CHEMIST.

*Beet Root.*—The beet root is cultivated in Germany for the purpose of producing sugar. The following is the method of extracting it:—The roots are taken up in autumn, washed clean, wiped, cut lengthways in slices, strung on threads, and hung up to dry: when dry they are macerated in a small quantity of water; this water is drawn off and poured on fresh roots, and more water added. To extract the most sugar with the least possible quantity of water being the great point to be gained, some merely express the juice from the fresh roots, and boil it down; others boil the roots; but the produce from these plans is not equal in quality to the first. The method of boiling and granulating is the same as that practised in boiling the cane juice in the colonies, a description of which is given in the Cyclopædia under the head "sugar." From 110lbs. of the roots may be obtained 4lbs. of well-grained white powder sugar, and from the residuums 7 pints of a sort of rum. Another proportion is,—from 1 ton of roots, 100lbs. of raw sugar, which gives 55lbs. of refined sugar, and 26lbs. of treacle. I give these proportions on good authority and in answer to your Correspondent G.'s question.

Yours respectfully,

R. G.

SIR,—I beg to state that the receipt for matches for instantaneous light given by "J. R. W." is incorrect. The following is the receipt:—Oxmuriate of potash ten grains, flour of sulphur ten grains, vermilion three grains, gum shellac powdered five grains, separately powdered and mixed up with spirits of turpentine to a thin paste with which coat the ends of slips of wood previously dipped in brimstone, and not dipped in spirits of turpentine as dictated by "J. R. W.," as of course the spirit will evaporate. The slightest touch would rub the mixture off the matches as made by "J. R. W." if the gum shellac was not added to combine the other articles.

I remain yours,

SANCHO.

## TO CORRESPONDENTS.

C. Parke's *description of the process of Paper Staining shall be inserted at the earliest opportunity.*

C. C. W.'s *plan, we are sure would never be acted upon. The grinders would rather die prematurely than adopt any system that would be attended with trouble. On account of the smallness of their earnings, they are obliged to perform their work in the readiest way. He had better purchase Blair's Chemistry, a cheap little work, where he will find every particular.*

F. H.'s *description of a Cheap Electrical Apparatus shall be inserted.*

*We shall be happy to receive any communication from J. G. His papers on the Electrical Stool shall be attended to.*

A Subscriber *must refer to our back numbers on Railroads. Sir Isaac Newton made a water clock which went very well.*

Q. E. D.'s *answer to* Alexis *shall appear next week.*

Carbon *shall be inserted in our next.*

*Received* Alpha, J. H. C., W. Y, W. H., *&c., &c.*

ERRATUM.—No. 51, page 84, col. 2, line 11, for "*vibrating*" read "*beating.*"

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LIII.] SATURDAY, OCTOBER 28, 1837. [Vol. II.


### ELECTRICAL EXPERIMENTS.

Fig. 1.

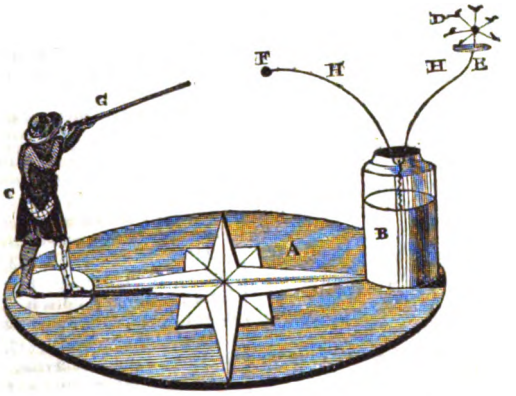



Fig. 2.

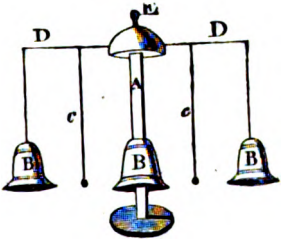
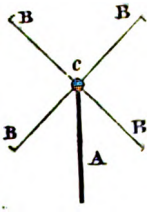



Fig. 3.





Holloway Press: D. A. Doudney.





Digitized by Google

## ON THE STUDY OF MECHANICS.

NO. III.

DEFINITIONS.

DEF. 1.—*Mechanics* is that science which describes the effects of forces in the production of the alteration of motion.

DEF. 2.—*Matter* is that which is capable of independent existence. *Perfect Matter* combines these three properties; *solidity, inactivity*, and *gravity*. The exact nature of *imperfect matter*, as light, heat, &c., are unknown; and their investigation is not the object of mechanics; therefore, by *matter*, must be understood *perfect matter*.

The Cambridge definition is as follows:—"*Matter is a substance, the object of our senses, in which are always united the following properties: extension, figure, solidity, mobility, divisibility, gravity, and inactivity.*"—Wood. Prin. Mec. Camb.

This definition is not only vague and obscure, but absolutely inaccurate. "Matter is a substance," explains nothing; "a substance is matter," would be equally intelligible. The next assertion, "the object of our senses," is incorrect. *Light* is the *only object* of one of our senses, and yet light is not *matter* according to the mechanical meaning of the term. *Sound* is the object of another sense; but sound can have no independent existence; it is a sensation caused by motion, and neither sensation nor motion are matter. It is difficult to establish either the truth or error of an ambiguous expression; for whatever view we take of it, the author may avail himself of the looseness of his expressions, and interpret them in a different sense: thus, if we understand "matter is a substance, *and also* the object of our senses," he may say no; we mean "matter is a substance, *and that substance* is the object of our senses." But however convenient ambiguity may be to an author, it is very inconvenient to the student, and ought not to be tolerated in a definition. Even if the intended meaning be correct (which is not the case in the present example), we must not on that account admit a definition which is not accurately *expressed*. In all definitions, neither more nor less should be expressed than is requisite to distinguish the object to which it refers; for this reason I omit *intention* and *figure*, they being only the consequence and attributes of *solidity*. And further, if we admit *figure* as a distinctive property, it will be found in many instances difficult to conceive; as a grain of salt dissolved in a large body of water, &c. *Mobility* is superfluous, being included in *inactivity*, and *divisibility*, is a negative property, and may be defined, *the absence of adequate force to resist separation*. Its demonstration is absurdly attempted by showing the *rational* divisibility of an *immaterial* line (Wood, art. 6). The more important property, *compressibility*, is inconsistently omitted. For these reasons, I wholly reject this definition, as imperfect and inaccurate.

DEF. 3.—*Solidity* is that property of matter by which it resists compression, and possesses *extension* or *size*; the boundaries of extension are called *figure*. The usual definition is "*that property of matter by which it fills space.*" To what extent matter really occupies space is unknown; that all bodies are essentially compressible will be demonstrated hereafter, and no limits can be assigned to that property; we cannot therefore assert with propriety that matter *fills* space.

DEF. 4.—*Inactivity* is the inability of matter to change its state of rest, or uniform rectilinear motion, without the action of some external impulse; and the force with which it resists such change is called the *inertia*, or *vis inertia*.

DEF. 5.—*Gravity* is that property by which every particle of matter attracts every other particle. It is only necessary for our present purpose to consider the gravity of the earth acting upon bodies near its surface; it inclines all bodies in a direction nearly perpendicular to the horizon; it varies in intensity in different latitudes, but acts equally upon every particle of matter in the same place.

In the common definition, we are told, that "it inclines all bodies towards the centre of the earth." This I reject, for the very sufficient reason, that it is untrue. The irregular form of the surface of the earth, and the unequal density of its parts, cause a perceptible deviation from the perpendicular line in the direction of gravity. This will be more fully explained hereafter. By what process detached particles of matter act upon each other we cannot even conjecture; but constant experience convinces us that such is the invariable and universal law.

Q. E. D.

## RAILWAYS.

AFTER a line of railway has been surveyed and levelled, and the position of the surface of the road determined on the section, it is necessary, in order to compute the contents, areas, &c., to find the inclinations of road for the whole length, and also the inclination per foot; from these

Digitized by Google

inclinations we can determine the height or depth of the surface of the road above or below the surface of the ground, as the case may be. It is my intention to give one or two simple rules for that purpose.

Now it is plain that if the height and length be given, the inclination will be equal to the height, divided by the length. Let H be the height and L the length, and resolving it into an analogy, we shall have

L : H :: I : incline for unit of length.

Assume L = 1000, and H = 20 feet then we have

1000 : 20 :: 1 : ·02 rise per foot.

That is, one foot in length will give a corresponding rise of ·02 of a foot; the proof is as follows:—

1000 × ·20 = 2000 = 20 feet,

which is the original height.

And therefore, generally having the length and height given to find the rise per foot, divide the height by the length, and the result will be the rise per foot.

The preceding gives the height or inclination to one foot in length; and to find the inclination for the whole we must reverse the operation, which is,

H : L :: I : incline on the whole.

20 : 1000 :: 1 : 50.

That is, the inclination is one foot in fifty. The proof is by reversion as follows:—

50 : 1 :: 1000 : 20 original height.

Therefore generally divide the length by the height; or it may be expressed,—

$$\text{Incline} = \frac{L}{H}$$

We may also find the inclination per foot from this last-found incline, which is the best in practice; as the incline on the whole is always required; and when this is found the other is readily attained by the following proportion:—

Let I = incline; then

$$I : 1 :: 1 : \frac{1}{4} \text{ incline per foot.}$$

$$50 : 1 :: 1 : \frac{1}{50} = ·02$$

same as found before by the other rule;

But both these may be expressed in one general rule.

Rule.—Divide the length by the height, and it will give the rise on the whole; then divide unity by this last-found incline, and it will give the rise per foot.

By collecting the symbols it will be

H : L :: : 1 incline on the whole.

..... $\frac{1}{4}$ incline per foot.

Numerically,

20 : 1000 :: 1 : 50 total.

..... $\frac{1}{50} = ·02$ per foot.

In my next I will send some examples of the practical method of applying these rules to the reduction of areas, contents, &c. Should any further explanation be necessary I shall be happy to give it.

J. L.

---

"——————" to interrupt
Your speculations, which I hop'd
Assistance from, and come to use,
'Tis fit that I ask your excuse.
By no means, sir, quoth Sidrophel,
The stars your coming did foretel."

Hudibras.

*To the Editor of the Penny Mechanic.*

Sir,—In the absence of positive data, I am compelled to resort to conjecture, in order to explain the cause of the ireful displeasure manifested by "Alexis" in his reply to some general observations of little importance in my first letter. On the 30th September the planet Mars was on meridian at about 2 P.M.; a very likely hour to be devoted to correspondence of this nature. "Friend Rough's" letter (in which you, Mr. Editor, were yourself hauled over the coals), judging from the time of its appearance, was also probably written at about the same period. This coincidence seems to corroborate the opinion that all this wrath was owing to the influence of that warlike planet.

"Alexis" appears to have misunderstood my meaning throughout; this I attribute to his want of attention, and not to any obscurity in my expressions; but he has carried the license of interpretation so far, in some of his remarks, that I feel bound to contradict them. He accuses me of applying uncivil terms to your correspondents; this I must seriously protest against; I *hope* it is to be attributed to a mistake on his part, for no ingenuity can *fairly* construe the passage to which he alludes into any personal insinuation. I cannot understand why the member of Parliament for Dublin is to be abused, because I happened to mention something about a stout gentleman at the baker's; (for this I conceive to be the great grievance which has incurred the displeasure of "Alexis,") nor can I understand the drift of his rigmarole about parachutes; all that I can pick up is, that the opinions most entitled to consideration are those of Mr. Green, who thought that Mr. Cocking's machine *would* descend safely, and Mr. Mason, who thought that it *would not*. This I must acknowledge is quite unanswerable; but lest I should be again misunderstood, I must inform Mr. "A." that I do not mean that such arguments are too cogent to admit of an answer, but too foolish to require one.

Digitized by Google

I beg our friend will not defer sending his parachute on my account, especially as we are about to be regaled with a fresh batch; and I have no "wonder workings" and "aboriginal ideas" to offer him, as he expects. I hope his next communication will be upon a more interesting subject, and influenced by a more benignant planet.

I remain, sir,

Your "ungenerous, vain, modest, ill-natured, pompous, wonder-working, disrespectful, sensible, sneering, consistent, hypercritical, aboriginal, indigestible" servant,

Q. E. D.

*To the Editor of the* PENNY MECHANIC.

SIR,—A correspondent in your last Number, who rejoices in the cognomen of "Alexis," is certainly a very strange sort of personage. After saying, in the first part of his letter, "I have always maintained a respect for *The Penny Mechanic* (if I may be allowed the term) grounded upon the perfect equanimity of temper which your able correspondents have displayed," he falls foul, in no very polite terms, of your able correspondent, "Q. E. D." Had he confined his remarks to him I should have had no fears as to the result, he being very well able to take care of himself. I have, however, a few words to say on another part of the letter. "Alexis" says, "the *ungenerous fling* at *Sir Andrew Agnew* would have been much better omitted; for however misled he may have been, no person can deny but that his motives were good." The motives of the worthy Bart. may be very good of the sort; I shall not therefore quarrel with them. But from the above-quoted passage, it would seem that "Alexis" dislikes an ungenerous fling; therefore he says, "Had he, instead of his name, introduced that of the *greatest humbug* of the age, D. O'Connell, he would have done much better." I should like very much to know from "Alexis" what right or title he has to call the hon. member for Dublin "the greatest humbug of the age." I say that Mr. O'Connell is no humbug, but that, on the contrary, he is one of the greatest patriots and statesmen of the age; added to which he is the friend of the working man. I will conclude this hasty note, by remarking, for the information of "Alexis," that the name of O'Connell will live in the hearts of millions of his countrymen long after his mortal remains shall have been laid in the dust, and when party virulence shall have ceased to attack him.

I am Sir, yours, &c.

J. F. S.

## SOUTHWARK OBSERVATORY,

*Nelson-street, Long-lane.*

ON the first establishment of this Institution, two years ago, it embraced only the opportunity of having access to the 30-ft. refracting telescope, intended to carry three series of lenses, and at present fitted up with one. Courses of lectures and a reading-room have since been added; and it is the object of the founders to render the means as interesting, and the ends as instructive and useful as those of any Society at present existing.

The whole undertaking was commenced and continues at the responsibility and sole expense of the Treasurer.

We hope the patriotic exertions of this individual may prove a national benefit, and source of gratification to himself; that through the means here offered for studying the delightful science of astronomy, the genius of some of our countrymen may be made to shine forth and spread a lustre on our nation.

The distinguishing feature of this Society consists in the possession of an extensive apparatus, designed to carry three powerful refracting telescopes, having a focal distance of thirty feet, yet so manageable as to be easily adjusted, by a single person, to any point in the heavens.

For the purpose of displaying to the public the object which the founders hold the more particularly in view, it was at first deemed advisable to announce courses of lectures on astronomy, or on subjects only that are intimately connected with it; this having been accomplished, the Committe have now the satisfaction of presenting a list of lectures, which, from their being more diversified, will, they doubt not, be esteemed more interesting by the generality of the members.

The Committee feel great pleasure in acknowledging the assistance proffered by several gentlemen of talent, in furtherance of the objects of the Institution.

The Reading Room is supplied with periodicals, and with a selection of works on scientific and general subjects. It is also furnished with globes, maps on various projections, tracing globes, apparatus, drawings, specimens, &c.

The privilege to visitors of admission to the observatory has been extended to the lectures; and in order to accommodate

Digitized by Google

occasional residents in London, to whom the opportunity of frequently attending the Institution during their stay would be highly desirable, a regulation has been adopted, by which, on payment of a trifling sum, visitors can be admitted to the observatory on five distinct evenings, and to one lecture.

To those who seek for rational gratification in the cultivation of intellectual and scientific pursuits, the Committee now address themselves, soliciting their support, by becoming subscribers to this truly national undertaking.

On Friday, November the 10th, an Introductory Lecture, on the Properties of Matter, will be delivered by W. Maugham, Esq., Lecturer to the Gallery of Practical Science, Belgrave Institution, &c. Admission by tickets, which may be obtained gratuitously on application. To be followed every succeeding Friday by popular lectures on astronomy and the various departments of physical science.

Terms of subscription for the use of the observatory and reading-room, and attendance at the lectures:

| | Per Ann. |
|---|---|
| A lady (ticket not transferable) | £1 1 0 |
| A gentleman, ditto | 1 11 6 |
| A lady or gentleman (one personal and one transferable admission) | 2 2 0 |
| Every additional transferable admission | 0 12 0 |

Terms for the admission of visitors, on entry of name and address, and compliance with the regulations of the Society:

| | |
|---|---|
| To the observatory, any evening (except Friday) | 1 0 |
| To the observatory five evenings and to one lecture | 2 6 |

Tickets for any particular lecture, one shilling each, may be procured any day previous to that of the lecture. Terms may be agreed on for the admission of societies, schools, &c.

All applications to be made at the Observatory, or to the Hon. Secretary, 6, Dean-street, Tooley-street.

## DAMASCUS STEEL.

The composition of the material formerly so celebrated as the steel of Damascus has given rise to many investigations, not merely on the point as to whether it was indebted for its appearance and elasticity to welded laminæ of iron and steel, or to some chemical peculiarity, but likewise whether a large proportion of the notions connected with its history and excellence may not have been fabulous. The most general opinion has been, that the variegated surface of oriental sabres results from their being composed of what the French call *étoffé*, or mixed metal; that is to say, a compound of bars or wires of steel, or of iron and steel, welded and wrought together, and twisted in different directions. In 1823, the Repertory of Arts published the translation of a paper, giving the result of a series of experiments undertaken by M. Bréant, examiner general of the assays at the Royal Mint in Paris. The French philosopher comes to the conclusion, that, instead of a mere mixture of metals, the oriental damask is in reality a cast steel, more charged with carbon than our European steels, and in which, by the effect of cooling, properly managed, a crystallisation is produced of two distinct combinations of iron and carbon. M. Bréant premises that the law discovered by Berzelius, according to which bodies combine that have any affinity for each other, explains, in a satisfactory manner, the property which characterises the steel of the orientals of becoming variegated at the surface, when, after being polished, it is submitted to the action of very weak acid. "Let us suppose," says the investigator, "that in the preparation of steel sufficient carbon have not entered, the steel formed will only be in proportion to the quantity of combined carbon; the rest will be iron, only mixed. The cooling then taking place slowly, the more fusible particles of steel will tend to unite together, and separate themselves from the portion of iron. This alloy will therefore be capable of developing a damask; but this damask will be white, but slightly marked, and the metal will not be susceptible of great hardness, because it will be mixed with iron.

"If the proportion of carbon be exactly such as it ought to be, in order to convert the whole of the iron into steel, there will be only one sort of combination: but if the carbon is a little in excess, the whole of the iron will be in the first place converted into steel. Afterward the carbon remaining in the crucible will combine in a new proportion with the part of the steel already formed. There will, in this case, be two distinct compounds, namely, pure steel and carburetted steel, or cast iron. These two compounds, at first mixed confusedly, will tend to separate when the liquid matter remains at rest. A crystallisation will then form, in which the particles of the two compounds will arrange themselves, according to their

Digitized by Google

respective affinity or their specific gravity. Let a blade, made of steel, thus prepared, be put into acidulated water, a very apparent damask will be developed, in which the pure steel parts will be black, and those of carburetted steel will remain white, because the acidulated water does not so easily show the carbon of the carburetted steel. The carbon irregularly dispersed in the metal, and forming two distinct combinations, is then that which occasions the damask; and it is obvious that the slower the cooling the larger the damask veins should be. For this reason it is, perhaps, necessary to avoid melting very considerable masses, or rather it will be requisite to make some modification in the process. In support of this opinion, I think I should quote Tavernier, who, in his Travels in Persia, has given some information which makes us acquainted with the size of the lumps of steel, which, in his time, were employed in making the damask blades: 'The steel susceptible of being damasked,' says he, 'comes from the kingdom of Golconda. It is met with in commerce in lumps about the size of a halfpenny cake. They are cut in two, in order to see whether they are of good quality or not, and each half makes the blade of a sabre.' From this account it is evident that the Golconda steel was in buttons, like *wootz*. Tavernier adds, that if, in the hardening of that steel, the methods of Europe were followed, it would break like glass. Hence it may be inferred that it is very difficult to forge, and so it was observed by Réaumur.

"This philosopher having received from Cairo some specimens of Indian steel, found nobody in Paris able to forge them. On this subject, he declares that it must be the fault of our workmen, for the orientals succeed in working this kind of steel. As carbon has the principal influence, not only upon the damask of the steel, but also on its intrinsic qualities, it is to be feared that Messrs. Stodart and Faraday may have been led into error in their labour, as I have been myself for a long time, and that they may have attributed to metallic alloys effects more particularly due to a greater proportion of carbon. I am, however, very far from contesting the existence of metallic alloys in the oriental sabres, although, in the few fragments that I have had occasion to analyse, I have found neither silver, gold, palladium, nor rhodium. It appears to me, nevertheless, very probable that various combinations may have been attempted.

"Plumbago has appeared to me, in some circumstances, to soften the steel, which an excess of carbon would render too harsh; at least, I have obtained excellent results with a hundred parts of steel, one of smoke-black and one of plumbago. But a very remarkable experiment, in regard to the advantage which may be derived from it, in working on a large scale, is, that a hundred parts of soft iron and two of smoke-black, melt as easily as common steel. It must be supposed that the whole of the carbon does not enter into combination. Some of our best blades are the product of this combination. It is evident from this experiment that it is not necessary, in order to obtain very good steel, to begin the operation by cementing iron. The iron may be treated immediately with the smoke-black, and this would greatly diminish the expense of the manufacture.

"A hundred parts of the filings of very grey cast iron, and a hundred parts of similar filings, previously oxydised, have produced a steel of a fine damask, and fit for the manufacture of bright arms. It is remarkable for its elasticity, a valuable quality not possessed by the Indian steel. The more carbon the steel contains, the more difficult it is to forge. Most of the specimens that I have prepared have not been drawn out but at a temperature, the limits of which are very confined. Heated to white-red they crumble under the hammer. At a cherry-red heat they become hard and brittle, and that disposition increases in proportion to the fall in temperature, so that once arrived below cherry-red, if we would remove a portion with a graver or file, they are found to be much harder and more brittle than after they are completely cooled.

"I am convinced, by experience, that the orbicular veins, called *rouces* by the workmen, which are seen on the fine oriental blades, are the result of the manner of forging. If we content ourselves with drawing the steel out lengthwise, the veins will be longitudinal. If we extend it equally in all directions, the damask has a crystalline appearance. If we render it wavy in the two directions, there will be shades and gradations, as in the oriental damask. It will not require long trials to be able to produce any variegated design we desire."—*Lardner's Cabinet Cyclopædia.*

We learn from a Portsmouth paper, that a lady, who has recently died, has left the sum of 200*l.*, to be given as a reward to any person who shall invent a machine which will supersede the use of boys in sweeping chimneys.

Digitized by Google

# THE CHEMIST.

## EXPERIMENTS IN ELECTRICITY.

Fig. 1, of the engravings in our front page, represents the Electric Sportsman. A is a stand of wood; B is a common Leyden jar, out of which proceed the wires H, one terminating in the ball F, the other in the ball D; surrounding which are small birds made of pith and feather, suspended to the ball D by silken threads; E a shelf for the birds to rest upon; C a sportsman; G his gun. The Leyden jar should be filled with electricity, and the birds will then fly round the ball. It should be then placed on the stand, and the sportsman's gun brought in contact with the ball F; a report will be heard, and the birds will fall as if dead. There should be a communication between the vial and the sportsman of metallic substances, as seen by the dotted line on the stand.

Fig. 2 is a representation of the Electric Bells. A is a glass pillar, fixed in a stand of wood, from the top of which proceed the wires D, terminating by two bells B, hung by a chain; C silken threads, terminating in brass balls. The electrical apparatus is then attached to the ball E; tongues C will then verberate against the bells. The middle bell is to have a hole at the top for the glass pillar to pass through. This will have a very pretty effect; the etectricity passes down the wire D to the bell, it then attracts the clapper, which, when loaded, it repels, to discharge itself against the middle one, and again returns. The bottom of the pillar should be coated with tin-foil from the bell downward.

Fig. 3 is the Wheel. A is a wire, to be placed on the conductor of the electrical apparatus; the wires B B B B to be bent round and terminate in a fine point. The wheel will turn round upon its axis at C.

WIGO.

---

*Method of preparing and using a Fulminating Powder.*—Take three parts of nitrate of potass, two parts of sub-carbonate of potass, and one part of sulphur; powder them separately, and dry them, by placing them on a tile before the fire; then mix them intimately, by rubbing all together in a warm mortar, and preserve the compound in a corked phial. Let half a drachm of this powder be spread on the bottom of a small iron ladle, and heated over a fire, it gradually blackens, and at last melts; at the same time it explodes with a violent report. It is not attended, however, with any danger.

*Fire produced by the mixture of two cold Liquids.*—Into a gallipot, placed on the hearth, pour three teaspoonsfull of oil of turpentine; then mix in a phial three teaspoonsfull of fuming nitrous acid, with one-fourth part of sulphuric acid; and pour this mixture suddenly upon the oil of turpentine; inflammation instantly takes place, accompanied by a large quantity of black smoke. It is advisable to fix the phial, from which the acid is poured, to the end of a long stick, as the sudden combustion occasions a part of the liquid to be thrown out of the vessel.

W. H. S.

*Cheap Pneumatic Trough.*—Obtain the half of a butter-tub, which can be purchased at any cheesemonger's for, at most, fourpence; then get a piece of deal, or any other wood, and burn two or three holes in it of a sufficient size for the shelf. Nail it inside the tub, about an inch below the intended surface of the water. Altogether the expense will not exceed sixpence. If available, it will be advisable to paint the tub, which will make it water-tight.

C. P.

*Very singular property of Camphor.*—If a small piece of camphor is placed on the surface of water contained in a basin, it immediately begins to move round and round with considerable rapidity. It is necessary that the water be pure, for if dust or grease be present the camphor will not move; or if, while its rotary motion is proceeding, a single drop of grease be let fall into the water, the camphor will instantly start away from it to the sides of the basin, and its motion will be put a stop to.—Nothing satisfactory has yet been advanced in explanation of this phenomenon.

*To show that the Atmosphere contains Water even in the driest weather.*—1. Expose to the open air for a few days a spoonful of dry sub-carbonate of potass, or muriate of lime, spread on a saucer; the salt will attract so much moisture from the air that it will become liquid. 2. Put a given quantity of strong sulphuric acid into a vessel exposed to the air; at the expiration of twenty-four hours its weight will be found to have increased one-third.

*To show that the Atmosphere contains Carbonic Acid.*—Expose to the open air, in an open vessel, a quantity of transparent lime-water; a white crust will soon form on its surface, which, on being broken, falls to the bottom of the vessel, and is succeeded by another. This preci-

Digitized by Google

pitate, upon being examined, proves to be carbonate of lime. Therefore carbonic acid is attracted from the atmosphere by the lime in solution. J. R. WATTS.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—I should feel obliged if "J." or any of your Correspondents who have made the air-pump described by him in No. 47 of your valuable periodical, would take the trouble to explain more clearly how the stop-cock is fixed into the cylinder, and which way it is placed in it, and by what outlet the air escapes, also how deep the cylinder must be let into the wood, and if there need be an air cushion.

Perhaps some of your Correspondents can inform me of some simple experiments that can be performed with the Cheap Electrical Apparatus.

Yours, &c., MERCURY.

Will Mr. Watts have the kindness to inform a lady how Court Sticking Plaister is made? The experiments resorted to have produced too brittle a sort. Also the method of preparing Cakes of Water Colours for drawing.

Sir,—Can any of your intelligent Correspondents inform me how to procure Pure Vegetable Oil, fitted for watches, &c.? PIVOT.

Sir,—Can any of the curious readers of your clever little work explain how a piece of card, in the form of a parallelogram, of two inches in length, by one and an eighth in breadth, may be cut in two, so that by placing one of the parts so divided in another position, it will form, together with its companion, a perfect square? This can be done, but by what calculation?

A. Z.

Sir,—Can any of your numerous Correspondents inform me how to construct or procure an Electrophorus, suited for a chemical laboratory? Also how to construct Electrical Apparatus, suitable to the Cheap Electrical Machines set forth in your valuable Magazine; such as Leyden Jars, pair of Directors, Luminous Conductor, Electrometers, Exhausted Flask, Discharging Rod, &c. A SUBSCRIBER.

[The postage of this letter was not paid.]

Dear Sir,—You will oblige me by giving insertion to the following queries:—

1. In what manner does steam produce the white deposit, or colour on funnels of steam-vessels, when in passing from the steam-pipes it plays on them?

2. We know that iron at a red heat possesses the property of decomposing steam, by combining with its oxygen, the hydrogen being set free; and we are also aware that this oxide of iron, at a red heat, can be restored to its metallic state, by passing hydrogen over it. Will some of your Correspondents be kind enough to explain this paradox?

3. Where can Coal Oil be purchased? If not sold, how can it be separated from gas tar?

4. By what means does Light decompose Nitrate of Silver, and how do the sun's rays effect the combination of a mixture of Chlorine and Hydrogen?

Yours, &c., W. Y.

## ANSWERS TO QUERIES.

"A Young Chemist" can purchase the Bottle and Tube, with screws to fit, air-tight, one within the other; also a piece of flexible metal tube (which can be bent to any shape, to convey the gas to the receiver), at Dymonds', operative chemists, No. 146, Holborn Bars, for 8s.—Also at Midgley's, 49, Strand; where he can obtain a Gas Bottle and Iron Tube ground in, together with a Flexible Metallic Tube, to suit the collection of gas, either by a gasometer or a pneumatic trough. The price will be 11s.

*Washable Varnish.*—This may be made by dissolving shell-lac in strong spirits of wine.

*Japan for Tin.*—Take of good linseed oil one gallon, and of umber half a pound; boil them together till the oil becomes very brown and thick; strain it through a coarse cloth, and set it again to boil, in which state it must be continued till it acquires a pitchy consistence, when it will be fit for use.

"W. S."—Common linseed oil, rendered very drying by being boiled with litharge, will, when applied to the tissue paper, and dried, by being placed near the fire, in the sun, or in any warm situation, (which precaution will be necessary to ensure its drying within the term of two or three days at furthest), fully answers the purpose for which it is intended, viz. that of rendering the balloon air-tight.

With regard to sticking the edges of the gores together, the best cement that can be used is a mixture of common glue and oil, melted carefully together without water.

As to inflating, carburetted hydrogen will not answer for a smaller balloon than one of twenty feet in circumference.

"Pickwick" will find the linseed oil much better suited to varnishing his balloon than any solution of Indian rubber. I am yours, &c. CARBON.

"A Schoolboy" will find some amusing Christmas Experiments in Number 8.

## TO CORRESPONDENTS.

*Does* A. Hewitt *think the model he made five years ago has been seen and taken advantage of by the persons who have now patented and brought it out as their own invention? Perhaps he can let us know his opinion by Monday next. To give publicity to the inventions of Mechanics, and to afford protection to their genius is the main object of this publication.*

"C. Taylor." *We intend shortly to give a description of the most approved Locomotive Engines at present in use on Railways.*

*The article sent us by* "Entity" *shall be inserted.*

*The attempt at perpetual motion, or rather the locomotive machine, of which our Correspondent has sent us a drawing and description, is not void of interest. We have sent the sketch to our Engraver's.*

"A Builder" *is informed that he is at liberty to erect the Fire Staircase, described in No.* 51.

ERRATA.—In Number 52, page 91, the fourth question should commence "an inflexible *cylindrical* vessel." Also, "when this quill is *fitted*," should have been *filled*. Q. 13, for "*æ*" read ae. Q. 17, for "*all*" read *at*. I take this opportunity of observing, that mistakes of this kind are unavoidable in correspondence, where the author has not an opportunity of correcting his own writings; so that what appears to be a confusion of ideas, is in reality only a confusion of type. This applies particularly to "Q. E. D," whose manuscripts are something between a physician's prescription and a washerwoman's bill, but less oblique than the latter; indeed the Editor once suppressed a whole paragraph because it *leant the wrong way*. Q. E. D.

Long-looked-for come at last!—A Magazine for the Boys!!

On Saturday next, November 4, will be published, with neat Engravings, price One Penny, a new Weekly Periodical, entitled

THE MAGAZINE FOR ALL THE BOYS; HOLIDAY COMPANION; and GENERAL STORY-TELLER.—The Book, instead of its Editor, will join them in all their amusements; though grave in the School-room, it will be a most cheerful associate in the Play-ground; will join them either at Cricket, or Marbles, or Leap-frog, or what they please. It will accompany them in their Fishing Excursions; make one of their Bathing Party; or seek with them the Bird's-nest. And when the setting sun reminds them of home, it will follow them thither, and in the social circle have many a pleasant Tale to tell.

London: G. Berger, Holywell-street; D. Doudney, Holloway; and all Booksellers.

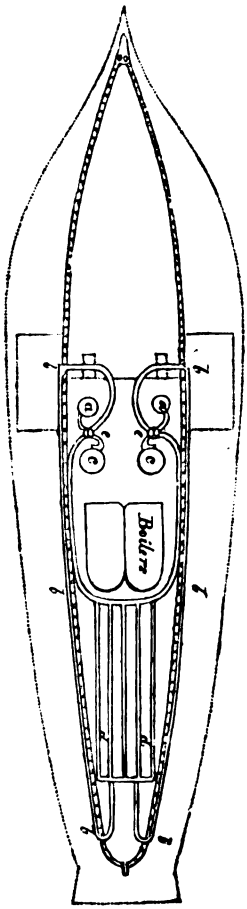
London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

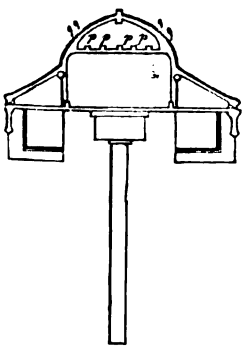
Digitized by Google

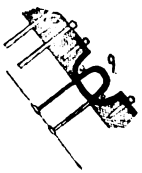
# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LIV.] SATURDAY, NOVEMBER 4, 1837. [Vol. II.

PLAN FOR WARMING STEAM-BOATS.





Vol. II.—No. LIV. Holloway Press: D. A. Doudney.

Digitized by Google

## PLAN FOR WARMING STEAM-BOATS.

*To the Editor of the* PENNY MECHANIC.

SIR,—May I request the favour of the insertion, in your Magazine, of the enclosed plan for condensing the steam in marine steam-engines, by which the heat of the steam may be partially employed in warming the cabin, or may allow it to cool at pleasure. Although simply warming the cabin is no very great object, yet the principle of condensation going on outside the vessel, I think might be turned to account, to save room, which is of great importance in marine steam-engines; and it would also answer the purpose of keeping the water clear for the use of the boiler. I am your obedient servant,

ARDENS.

EXPLANATION OF THE DRAWING.—The steam is conducted by tubes after leaving the cylinder (*c c* in the horizontal plan), to the after end of the vessel, and thence back again to the air-pumps *a a*. In part of their course the tubes are placed longitudinally along the outside of the vessel, in place of certain strokes of the planking, as at *b b* in both figures, in order that they may be exposed to the contact of the external water. In other parts of their course they pass under the cabin floors, as at *d d*. The portions of the tubes respectively nearest the cylinders and air-pumps, approach each other closely at *e e*, where they both pass through four-way cocks, by arranging which the steam may be made at will to pass round the outside of the vessel first, and be condensed before coming under the cabin floor, or else under the cabin floor before condensation, thus warming or cooling the cabin at pleasure. ARDENS.

*To the Editor of the* PENNY MECHANIC.

SIR,—Number 51 of your Magazine contains a description of a Fire Staircase, as projected by H. Plummer; I should be sorry to deny that it is a very ingenious plan, but I fear the obstacles to its practical utility (on which I beg to make a few remarks) cannot be overcome. In the first place, with respect to the waste of ground, which in situations such as Lombard-street, where it is so valuable, I consider that not one out of fifty would make the sacrifice that must accrue in the length of a street. But even were this sacrifice submitted to, I doubt whether, in the confusion occasioned by a fire, the usual number of inmates in every house would have sufficient presence of mind to allow each other to descend safely; it is more than probable that some would be precipitated into the street. Indeed, I much fear whether any thing within the scope of human ingenuity can effect what has already been so laudably attempted in order to anticipate the distressing difficulties in question. It is rarely indeed that the instructions of those who sit down to write, in a calm state of mind, can be followed by those suffering by distressing casualties of any kind whatever. It has been justly observed, that "fire and water are good servants, but bad masters;" and all that can be said is, that it is a truly praiseworthy attempt to reduce them to the obedience of man. That presence of mind which we ought at all times to cultivate, is as equally requisite in a shipwreck as in a conflagration. The weak and timid will find difficulty in making use of the best-contrived apparatus, whilst the bold and resolute will find means of escape, influenced alone by the difficulties of the moment. I remain, Sir,

Your constant Reader, W. E. F.

[We are perfectly aware of the prejudice which is always shown in favour of old customs. This brings to our mind the story of a Dutchman, who, rather than he would divide the weight of a sack of flour on his mule's back, threw the whole on one side, with a proportionate weight of stones on the other to balance it,—because his father did so before him.—New inventions are generally considered either as innovations or impracticable. The same opposition was shown when a Legislative enactment made it imperative to erect party-walls in new buildings.]

## HOW TO EXTINGUISH FIRE.

*To the Editor of the* PENNY MECHANIC.

SIR,—Presuming you will insert any article in your Magazine that is curious and interesting, and at the same time that may become of use at some future period, I beg to ask the favour of your granting me a place in your columns, of the following method of Extinguishing Fire with a certainty of its not breaking out afresh.

As soon as the engine is in readiness to work, mix in the water that is immediately to be discharged, seven or eight pounds of pearl ashes, in powder, and continue to add it in this manner as occasion requires, taking care that it be directed against the timber or wainscot, &c., just beginning to burn. Or, when time will admit, dissolve any quantity of pearl ashes in a copper with water, and as fast as it dissolves, which will be in a

Digitized by Google

few minutes, mix a pailfull with the water in the engine pretty often; and whatever burning wood it is played upon, the fire will be extinguished, and it will not burn afresh. I remain yours, &c., Boz.

## ON THE STUDY OF MECHANICS.

NO. IV.

Sir,—In your Number 51, there is a description of a Fire Staircase, by Mr. Plummer; whatever reception it may meet with from the public, it is an excellent contrivance; and I think I am only expressing the sentiments of the majority of your readers, when I thank him for making it known. If we were accustomed to such protection, we should deem it imprudent and dangerous to be without it. A certain and easy deliverance *from* fire is not the only advantage obtained; it is also a protection against nocturnal depredators. Some men possess such strength of nerve and confidence in their own power and courage, that no imaginary, or even probable, danger, occasions them the least uneasiness; but nervous and timid people, whose preservation may be equally important to society, and unquestionably an object of their own especial solicitude, would not, I should think, regret the trouble or expense of a structure which would ensure them a safe retreat from fire, thieves, and murderers. There is, however, one inconvenience attending this plan, which I merely mention, in order that Mr. Plummer may apply a remedy. If every inmate of a house has at all times access to this Staircase, they might be tempted to make an illicit use of it; boys would get out upon nightly frolics; the maid would avail herself of the accommodation to enjoy the edification of some intelligent lover; and many other uncocker-like practices would be alarmingly facilitated. Even if it were to terminate in a subterraneous place of temporary refuge it would be a dangerous place of concealment. That this defect may be remedied I have not the least doubt; and I call the attention of Mr. Plummer to the subject, because I am convinced it cannot be in better hands. I think it would be less objectionable if entirely closed in the front: and I should like it to be more than 18 inches wide, otherwise a lady or gentleman 20 inches thick would stick fast and prevent others from descending. But I am, perhaps, only anticipating alterations which the inventor's own reflection will suggest to him.

Allow me, Sir, to avail myself of this occasion, to explain my views regarding descriptive communications in general: I divide them into three distinct classes, each possessing its peculiar merit.

1st. Descriptions of things and processes which are only partially known, or which require the aid of science in their explanation.

2nd. Improved methods of obtaining a required result; or methods which render the result more perfect or efficient.

3rd. Original inventions. Great scope should be allowed to this section; for however imperfect, crude, or extravagant an idea may at first appear, it should, if really original, be entertained and investigated; for though it should be evidently incapable of effecting the object proposed, it may form the nucleus of other inventions; therefore the utmost facility should be afforded to the publication of the emanations of genius, however vague and incomplete they may be.

There is an incomprehensible light in the creative mind, which is independent of all external circumstances, and which no artificial process or cultivation can create; however neglected and uninformed, it still brings forth its blossoms; but if science ripen not the fruit, they will wither in the bud, and fall abortive and unheeded. Let me then exhort all those who have conceived projects which they have not an opportunity of carrying into effect, to bring them forward, and add to the stock of public knowledge, by making them public. The date of the publication will furnish them with an incontestable proof of the priority of their invention, should others attempt, unfairly, to appropriate it: and let them be assured that this work will fall into the hands of many who are fully capable of appreciating their productions, whatever they may be.

Although I wish to see every encouragement given to the publication of inventions, I think indulgence may be carried to too great a length. Many inventors, particularly incipient ones, feel a pride, which is far from blameable, when they are able, by means of publication, to communicate their discoveries to 20 or 30,000 persons: I have no doubt we are indebted to this sentiment for much information which would otherwise have been lost in the oblivion of the "old gentleman with a scythe." This sentiment would, I think, be promoted by the exclusion of projects which are wholly useless. There is, for instance, in Number 50, an account of an air-pump, made of a pair of bellows: whether this be intended

Digitized by Google

as a mystification, or written by a person unacquainted with the subject, I cannot determine; but if the writer had informed us that he could make a fiddle with the tongues and poker it would have been equally practicable and interesting. I am aware that it is difficult to draw a line between useful and useless things; and I admit that it is better to incline towards indulgence, than hazard the discouragement of those who seek to acquire or propagate knowledge: I only wish to suggest that it would be advantageous to readers, as well as to the writers themselves, if such communications as the one I have just mentioned, were not published. Trusting that the unreserved sincerity of my observations may not be misconstrued or condemned, I remain, Sir,

Your obedient servant,

Q. E. D.

[We are decidedly of opinion that the Fire Staircase is an excellent invention, and are much pleased to find that our highly-talented correspondent, "Q. E. D." has expressed his opinion so favourably of it. Had it been brought forward by an individual with the F. R. S., and about a dozen other titles attached to his name, the plan would, no doubt, have been acted upon immediately.]

## HEAT.

NO. I.

It may be justly said of that particular branch of science which will be treated of in these papers (heat) that it is of primary importance to all mankind, considering how greatly it appertains to the very existence of all organized bodies. Bacon speaks of it in these words: "It is certain that of all the powers in nature, heat is the chief, both in the frame of nature and in the works of art." And in the present day, Dr. Lardner, in his Treatise on Heat, says, "Heat is every where present." Every body that exists contains it in quantity without known limits. The most inert and rude masses are pregnant with it. Whatever we see, hear, smell, taste, or feel, is full of it: to its influence is due that endless variety of forms which spread over and beautify the surface of the globe. Land, water, air, could not for a single instant exist as they do in its absence; all would suddenly fall into one rude formless mass, solid and impenetrable. The air of heaven, hardening into a crust, would envelop the globe, and crush within an everlasting tomb all that it contains. Heat is the parent and nurse of the endless beauties of organization; the mineral, the vegetable, and animal kingdom are its offspring. Every natural structure is either immediately produced by its agency, maintained by its influence, or intimately dependant on it. Withdraw heat, and instantly all life, motion, form, and beauty, will cease to exist; and it may be literally said, "Chaos has come again."

I propose to divide the present subject into three papers: 1st, the general effects of heat; 2nd, conduction, radiation, &c.; 3rd, the sources of heat.

In taking a review of the general effects of heat, the least contemplative mind cannot fail to notice that solids, liquids, and æriform bodies, are all alike subjected to its influence; and it will be my chief object in the present papers to introduce to the student such experiments as shall combine amusement with instruction, and tend to impress these facts firmly on his memory.

I shall begin with solids. Procure a cylindrical piece of brass, about 4 inches long, and from two to three inches in circumference; into the side of which screw a stout wire, about a foot long, to which a wooden handle can be adapted; and having accurately noted the length and breadth by two apertures in a flat piece of brass, place the cylinder in the fire, and when red hot it will be found too large to fit into the apertures which before respectively measured its length and breadth, thus proving, in the most satisfactory manner, the expansion of solids by the application of heat, and their contraction on cooling; for on the cylinder becoming cold it will fit into the apertures, as at the commencement of the experiment. The expansion of solids being minute the cylinder must be made to fit accurately into the apertures in the flat piece.

Of the expansion of liquids by heat we have many familiar examples; for instance, advantage is taken of this property of liquids for the construction of an instrument whereby we are enabled to ascertain the temperature of the surrounding air, or any other body we wish. I refer to the thermometer. The expansion and contraction of the liquid in the glass tube (it matters not whether it is spirit or quicksilver, both being equally liquids), must be so familiar to every one, that I do not deem it necessary to say more on the effects of heat on liquids, but shall proceed to notice more fully its effects on æriform bodies, which can be rendered much more conspicuous by experiment than either liquids or solids.

Digitized by Google

The expansion of air may be shown by holding a bladder, containing only a small portion of air, with the mouth firmly tied, before the fire for a few moments; the air contained therein will expand, and it will soon appear to be fully inflated; but on removing it into a colder part of the room, it will resume its ordinary appearance. Another way of showing the same, which is often resorted to, is to take a small glass tube, which terminates in a bulb; plunge the open end into a glass of water; apply the heat of a candle to the bulb, and the air contained therein will escape from the open end in small bubbles, through the water: on removing the candle, the air contained in the bulb will resume its ordinary dimensions, and the water will gradually rise in the tube, so as to nearly fill it.

What are termed gridiron pendulums are constructed on the important principle of counteracting the effects of the variations of temperature which is continually going on in the surrounding atmosphere. It being well known that as the distance from the point by which the pendulum is suspended, to that part of it called the centre of oscillation, varies, the clock will vary; in the gridiron pendulum the bars of metal are so placed, that while some increase in length downward, the others increase upward, so as to cause the centre of oscillation always to remain stationary.

SCIOLISTERUS.

## NOVEL METHOD OF RAISING SUNKEN VESSELS.

We learn, from a Gravesend paper, that Mr. Kemp is endeavouring to raise the Apollo, steamer, and the William, of Sunderland, both sunk near Gravesend. The following was the plan adopted:—A large schooner was brought to the spot, containing 32 cylindrical vessels, each 6 feet high, by 4½ in diameter, lined throughout with zinc, and having only one head. Across the open end is a strong iron, which is firmly attached to the machine, with a hook in the centre. After the situation of the vessel had been discovered by the divers (who made use of Dean's diving apparatus), they proceeded to pass a chain cable entirely round the vessel from head to stern. To this, at distances of 6 feet, is attached short bridle chains; and to the end of each of these a rope with a buoy attached to it, which floats on the surface. When every thing below is complete, the rope is passed through the eye at the open end of the cone. The cone is then cast overboard and immediately fills with water, and descends exactly to the bridle chain. The diver then goes down and secures the two together. As soon as a sufficient number are attached, a tube, connected with the air-pump, is placed under the open end, and the air is then forced from the pump into the cone; and as soon as it leaves the tube, rises naturally inside the vessel and displaces the water by taking its place at the upper end. The cylinders are filled in this manner by degrees, taking the alternate sides of head and stern first. Water being a non-elastic fluid, will naturally cause a body that may be sunk to rise to the surface as soon as it shall be made lighter by the elastic fluid contained in the cylinders. The vessel lying in mid-channel is being continually run over by other vessels, and the chain round the vessel has several times been carried away by the anchors of colliers and others getting foul of it. The buoys attached to the bridle chains have also been over and over again destroyed by the paddle-wheels of the steamers. It is, however, the opinion of most persons that Mr. K. will eventually succeed.

## IMPORTANT INVENTION OF A NEW PADDLE-WHEEL FOR STEAM-BOATS.

Dr. Christopher C. Rice, of this city, Dr. Anthony Hermage, Professor of Chemistry and Natural Philosophy, at Mount St. Mars's College, Emmetsburgh, and Professor J. Gillmeyer, of Baltimore, are associated as proprietors of a newly-invented paddle-wheel for steam-boats. As the paddle of the wheel now in use, when at work, strikes the water at an angle of 36 or 37 degrees, the water, of course, offering its resisting force to the nearly-horizontal paddle, a great degree of steam power must necessarily be applied to the main crank, so as to overcome the resistance of the opposing element. Thus, from the shock made by the two conflicting powers, the boat sustains a shock or jar, and causes the plunge of the steamer at each stroke of the paddle, which is not only as unpleasant to the passenger as it is injurious to the vessel, but it retards the progress of the steamer also. The new patent paddle strikes the water perpendicularly, thus doing away with the cause of the convulsive plunge of the boat. It works at almost any depth under water, thus proving itself fit for the ocean equally as for the river boat. It rises also perpendicularly, and thus causes no "back water;" and on this account shows itself applicable to canals, as it is to oceans or rivers. All this is effected

Digitized by Google

by the manner in which the paddles work —viz. on the cranks and pivots, and an eccentric revolution of its wheel. All the extra power requisite to be applied to the present paddle in use, for breaking at first, and lifting afterwards, the water, is saved in this instance; and which, at a moderate calculation, must be equal to one-third of fuel, and propel the boat one-third faster. Some of the most scientific men in the country, who have seen this beautiful piece of machinery, have highly praised it. We recommend it to the serious consideration of those who at this time are engaged in steam-boat navigation.—*American Paper.*

[Our illustrious countryman, Symington, invented the steam-boat; Fulton, the American, took drawings and plans of it; and then went to his own country and palmed it off as his own invention. We have little doubt but the present American *discovery*, ushered forth to the world with such a string of pompous names attached to it, is somewhat similar. The above account was transmitted to us (accompanied with a letter) by "A. Hewitt," the inventor of the Upright Paddle-wheel described in Number 50 of our Magazine. He states, that he made his model five years ago, and exhibited it to any one who asked permission to see it. He afterwards lent it to a person named M'Caulay, a corn miller, who had two sons, the eldest of whom was considered a very ingenious young man. A short time after this they both went to America; and the writer says, he believes they are the persons who have made his invention known.]

## ORIGIN OF THE DERBY SILK-MILL.

A CORRESPONDENT who writes to us, complaining of the injury done to the silk trade by the introduction of machinery, is not aware that Italy formerly supplied this country with that article, in consequence of the machinery it possessed. The following is the history of the establishment of the silk mill in this country:—

The Italians had been long in the exclusive possession of the art of silk-throwing, when, about the year 1715, a young mechanic and draftsman, named John Lombe, resolved on the perilous task of travelling into Italy, to procure drawings or models of the machines used there. He remained some time in Italy, and procured admission to the silk-works by corrupting two of the workmen, through whose assistance he inspected the machinery in private, and whatever parts he obtained a knowledge of, during these visits, he recorded on paper before he slept. When he had just completed his plan his intention was discovered, and his life being in extreme hazard he was compelled to take refuge on ship-board. Two Italians, who had favoured his scheme, and whose lives were in equal danger, accompanied him, and they all soon landed with safety in England. Fixing on Derby as a proper place for his purpose, he agreed with the corporation for an island, or swamp in the river, 500 feet long, and 52 feet wide, at 8l. yearly. Here he established his silk-mill. In the year 1718 he procured a patent to secure the profits thus arising from his address and ingenuity, for the term of 14 years; but his days verged to a close, and before half this period had elapsed, treachery and poison had brought him to the grave. The Italians, whose trade rapidly decreased, from the success of the new establishment, were exasperated to vengeance, and vowed the destruction of the man whose ingenuity had thus turned the current of their business into another channel. Through the machinations of an artful woman, sent from Italy for the purpose, they were but too successful. John Lombe was succeeded by his brother William, whose melancholy disposition led him to commit suicide; on which the property descended to his cousin, Sir T. Lombe. Previous to the expiration of the patent, Sir Thomas petitioned Parliament for a renewal of it; but the Government, willing to reward the promoters of national benefit, and at the same time to spread the knowledge of such a useful invention, granted him 14,000l. in lieu of a new patent, on condition that he should suffer a complete model of the works to be taken. This was accordingly executed, and afterwards deposited in the Tower for public inspection, and it is from this circumstance that Sir Thomas Lombe is generally, but erroneously, reputed to have introduced the silk-mill into England.

The extensive fabric occupied by the machinery stands upon huge piles of oak, doubly planked, and covered with stone-work, on which are turned 13 stone arches that sustain the walls. Its whole length is 110 feet; its breadth 39 feet; and its height 56 feet. It consists of 5 stories, besides the under works, and is lighted by 408 windows. The whole of this elaborate machine, which contains 14,000 wheels, is put in motion by a single water-wheel, 23 feet in diameter.

The above is a description of the building in its original state.

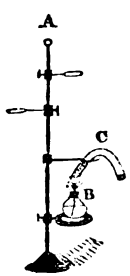
Digitized by Google

# THE CHEMIST.

## CURIOUS CHEMICAL EXPERIMENT.

HAVING procured a piece of thin glass tube, about 9 inches long and ¼ of an inch in diameter, hermetrically seal it at one end, and then bend it in the shape of the accompanying figure, which may very easily be done by holding it in the flame of a common candle or lamp till it becomes softened, and then pressing it gently with the hand till it assumes the required form; then take about half a dram of tartrate of lead (which may be procured at any chemist's shop), and having introduced it into the lower end of the tube, gradually heat it over a spirit or oil lamp till the tartrate of lead becomes quite blackened. As soon as this is the case remove it from the lamp and stop the open end of the tube with a cork. When the tube and its contents have become cold, if the cork be removed, and a little of the black powder shaken out on a plate, it will immediately take fire, and become like a little mass of red-hot charcoal.

N.B. The tube must be corked up again immediately the powder has been shaken out; and if care be taken to fasten it up tight, the powder remaining in the tube will retain the quality of igniting when exposed to the air, for several days and even weeks.




EXPLANATION OF THE FIGURE.—A, retort stand, holding the tube and its contents; B, the spirit-lamp, heating the tube; C, the glass tube and its contents.

*Fleet-street.* J. G.

## CHEMICAL TESTS, OR RE-AGENTS.

*Liquid Ammonia* is an excellent test for copper, with which it strikes a fine blue colour.

*Solution of Soap in Alcohol* is employed to ascertain the comparative hardness of water. With distilled water it may be mixed without any change ensuing; but if added to a hard water, it produces a milkiness more considerable as the water is less pure. This effect is owing to the alkali quitting the oil whenever there is present in water any substance for which the alkali has a stronger affinity than it has for oil. Thus all uncombined acids, and all salts, except those of alkalies, decompose soap, and occasion that property in water which is termed hardness.

*Carbonic Acid* (applied either in the gaseous or liquid state) occasions a white precipitate in lime, soluble with effervescence in muriatic acid.

*Nitrate of Mercury* (in solution) is the most sensible test of ammonia; one part of which, with 30,000 parts of water, is indicated by a slight blackish-yellow tinge on adding the test.

*Metallic Tin and Nitro Muriate of Tin* (in solution) throws down gold in form of a purple oxide. On the same principle nitro-muriate of gold serves as a test for tin.

*Liquid Sulphuretted Hydrogen* is a test for both lead and arsenic; with the former it gives a black, and with the latter a yellow precipitate.

---

The following experiments are intended to give an idea of the great power and usefulness of these tests:—

*A beautiful Green Liquid produced by mixing a Blue one with a Colourless one.*—Nearly fill a test-glass with water, and add to it a spoonful of the tincture of cabbage; the mixture will be of a fine blue colour. Add next a few drops of colourless liquid ammonia; the mixture will instantly become green.—Rationale: this experiment is designed to exhibit one of the distinguishing properties of alkalies; namely, that of changing vegetable colours. A solution of potash or soda produces the same effect as liquid ammonia; but if the liquid made green by ammonia, be boiled, it regains its blue colour; because that alkali being volatile, is driven off in the gaseous state by the heat.

The following experiment shows the mode of using the common test for alkalies:—

Into a test-glass of water pour a few drops of an alkaline solution, and then dip into the mixture a slip of turmeric paper; the pale yellow colour of the test-paper will be changed to a deep brown.

Digitized by Google

*Southwark Astronomical Society*, Nelson-street, Long-lane.—On Friday, Nov. 10. Mr. Maugham will deliver a lecture on the General Properties of Matter. Admission by Tickets, which may be had gratis.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—I should feel much obliged if any of your readers would inform me how to construct a Spring Movement which would take about eight hours to run down, and which would strike off an alarum during its action. And also how those Spring Thief Alarums are constructed, which, on being disturbed, strike a bell similar to that of a Dutch clock.

H. MARSHALL.

Given two sides of a triangle (equal 34 and 24 feet), whereof the greater is parallel to the horizon. It is required to determine the length of the third side, so that the descent of a heavy body along the same may take the least time possible? BOZ.

SIR,—I remember being told some time ago that it was possible to raise a pot of mustard and cress in a few minutes after the seed was set, by means of electricity or galvanism. If any of your Correspondents can inform me whether such is the case, and if so, how to perform the experiment, they would greatly oblige A YOUNG MECHANIC.

SIR,—Your Correspondent, "Syret," who presented your readers with a plan for a Watch Alarum, would much increase the value of his communication by describing more minutely the manner in which the weight J is hung from the sliding piece F, and how it is disengaged therefrom, so as to fall on the lever K. In doing this at his earliest opportunity he will much oblige, J. J.

SIR,—I wish, as an experiment, to make a wheel revolve by electro-magnetism, such as I have seen in the Lowther Arcade; but not knowing how to do so, I should be obliged if any of the readers of your miscellany could favour me with full directions, with the probable cost of the necessary apparatus.

Yours, &c. QUESTOR.

SIR,—Having tried many experiments to dry India Rubber when melted without success, I shall feel greatly obliged if any of your numerous Correspondents will inform me of the best method.

Yours, &c. BOZ.

SIR,—I should feel much obliged if any of your Correspondents could inform me of the best and cheapest method of preparing Permanent Blue and Red Writing Inks, which will not fade in their colours. And also the cheapest and best mode of preparing the Nitrous Oxide, or Laughing Gas.

*Bristol.* Yours, &c., A SUBSCRIBER.

Number 46 contains a description of the method of preparing Laughing Gas.

## ANSWERS TO QUERIES.

"A. B." Number 48, asks for a description of Mr. Hall's Steam Engine. That gentleman says, "The leading features of my invention consist, firstly, in effecting the condensation of the steam from the working cylinder, without injecting water (which in most cases contains impurities), into the condenser, by which means I am enabled to employ the same water constantly over and over again, to furnish steam; and the boilers being once charged with pure water it will always continue to be in that state, however long it may be used. Secondly, in securing the steam that usually blows away at the safety-valve, and returning the distilled water resulting therefrom to the boilers, and producing, by very simple means, the needful portion of distilled water to supply the waste that may take place in working the engines: and thirdly, in the oil for lubricating the pistons and valves being used over and over again, instead of its being washed away as in injection engines."

SIR,—I should advise your Correspondent, "W. H. P." to remove the flesh from the legs and wings of the birds he intends to stuff, if they are large; if small he will not be able. As to the shape of the wires for their support I cannot give any general rule.

Mr. Watts feels most happy in being able to oblige "A Lady," and hopes she will find the following receipt succeed:—*Court Plaister.*—Black silk is strained, and brushed over with a solution of isinglass an ounce, in proof spirit twelve ounces, to which is added two ounces of tincture of benzoin; when dry, this is to be repeated five times more; after which two coats are given of a solution of Venice turpentine, four ounces, in tincture of benzoin six ounces, which renders it less liable to crack; but some finish it with a simple tincture of black balsam of Peru.

*Water-colour Cakes.*—The colours are to be ground with gum-water, to which a little isinglass has been added; it is then to be put in a greased mould, and dried with a slow heat.

In answer to your Correspondent, "Sancho," I beg to state, that the receipts I gave for making Matches for Instantaneous Light are those in general use, if the ingredients are properly mixed I have never found them rub off. I am quite aware that a portion of the turpentine into which the wood is dipped evaporates, but the portion which is left behind, renders the wood extremely inflammable. I should advise him to give them both a fair trial, and I am sure he will find mine preferable, as they do not leave so disagreeable a smell as the sulphurised ones, and light quite as well. And I would ask him how it is the sulphurised ones sell for a shilling a thousand less than the others.

J. R. WATTS.

## TO CORRESPONDENTS.

A. W. Collins. *By inserting his Letter we should frustrate the object he has in view; viz. that of putting an end to party quarrels.*

T. M. Vaughan's *Safe-Guard for Steam-Carriages shall be inserted the earliest opportunity.*

*We are obliged to* Mr. Watts *for the papers he has sent us.*

*The Electrical Experiments sent us by* Wigo *will, no doubt, be acceptable to our readers, for which we return him thanks.*

Sciolisteros *will see that we have made use of the first of his papers on Heat. We thank him for his communication.*

A Friend to Improvement. *We think it will be impossible to guide Balloons until some powerful machinery, similar to the wings of birds, can be brought into action to propel them. A ship, when sailing, has two elements acting on it, while a balloon has but one; consequently it must go with the current.*

Mr. Burbridge's *communication on Thunder Clouds shall have a place in our Magazine.*

Long-looked-for come at last!—A Magazine for the Boys!!

Just published, with neat Engravings, price One Penny, a new Weekly Periodical, entitled,

THE MAGAZINE FOR ALL THE BOYS; HOLIDAY COMPANION; and GENERAL STORY-TELLER.—The Book, instead of its Editor, will join them in all their amusements; though grave in the School-room, it will be a most cheerful associate in the Play-ground; will join them either at Cricket, or Marbles, or Leap-frog, or what they please. It will accompany them in their Fishing Excursions; make one of their Bathing Party: or seek with them the Bird's-nest. And when the setting sun reminds them of home, it will follow them thither, and in the social circle have many a pleasant Tale to tell.

London: G. Berger, Holywell-street; D. Doudney, Holloway; and all Booksellers.

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LV.] SATURDAY, NOVEMBER 11, 1837. [Vol. II.


### PARACHUTES.

FIG. I.

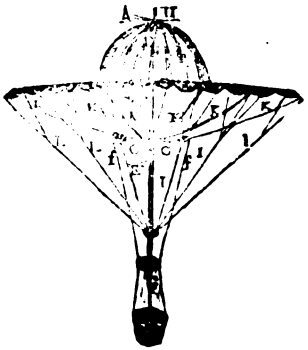
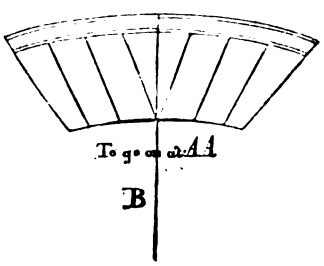


FIG. II.



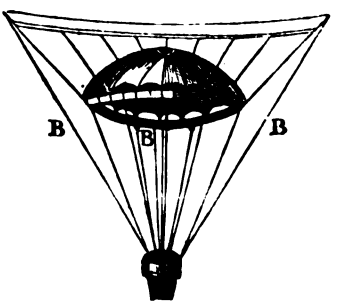
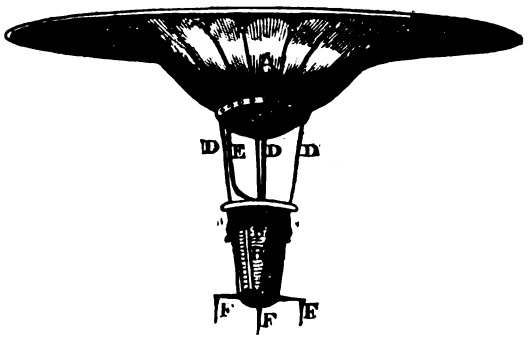




FIG. III.







Holloway Press: D. A. Doudney.



Digitized by Google

## PARACHUTES.

(FIG. I.)

*To the Editor of the Penny Mechanic.*

SIR,—Having constructed a parachute on a different plan to any I have yet seen, and of which I have sent you a drawing, I have made calculations and experiments, and they have always answered my fullest expectations. If you think it worthy of your notice, an insertion will oblige

Your obedient servant,

J. BURNE.

EXPLANATION OF DRAWING.—Fig. 1, the parachute descending. A the valve, to prevent the oscillation; B the valve-line; C a ash-hoop; D the cone; E the inverted cone; F a tube, reaching from the æranaut to the valve, through which passes the rope H, by which the parachute is attached to the balloon; I is an iron pin, by which the æranaut is to relieve himself, and thus avoid all inconvenience from ropes falling on his head; J four ropes, by which the basket is hung to the hoop; K twelve ribs fixed to the hoop; L twelve ropes, reaching from the tube to the end of each side, with branch ropes to prevent its collapsing.

Fig. 2, the parachute ascending. M is a stop-joint, by which the ribs are fixed to the hoop.

Yours, &c.

J. BURNE.

(FIG. II.)

*To the Editor of the* PENNY MECHANIC.

SIR,—You will see by the drawing that my parachute is nothing more than Mr. Cocking's, and the orifice at the bottom filled up by one after Garnerin's principle. So certain am I of its safety, that I intend putting it to the test next summer. The parachute is prevented from oscillating by Mr. Cocking's Machine, and from coming down too fast by Garnerin's.

I have given a separate diagram of Cocking's, thinking it may show the construction better.

B B B ropes to prevent its collapsing; B to fix on at A A A.

I remain your obedient servant,

SAVILLE.

(FIG. III.)

*To the Editor of the* PENNY MECHANIC.

SIR,—Although the unfortunate descent of the late Mr. Cocking, which terminated the existence of that gentleman, is in the highest degree lamentable, yet it has been the cause of rousing the inventive spirit of all those who interest themselves in the science of ærostation, to invent a new parachute, or to improve that of Mr. Cocking; and I feel convinced that parachutes will soon be brought to such a state of perfection, that they will be the instruments for saving many a life, instead of being the cause of the death of more of our fellow creatures. Encouraged by an article in No. 31 of your Magazine, which says, "that a great many useful things are lost because persons are afraid of making their thoughts public, for fear of being ridiculed," I beg, if you think this worthy of occupyiny a place in your interesting Magazine, to honour it with an insertion.

Yours, &c. A. B.

DESCRIPTION.—A the parachute; B the car, high enough to reach up to the neck of the aeranaut; C an opening, containing a bag filled with common air, and from which an Indian rubber pipe, E, leads down into the car; the pipe has a mouthpiece and a stop-cock, so that when the æranaut makes his descent, by putting the pipe in his mouth, and opening the cock, he will be supplied with air; D D D are four steel rods, which form the communication between the parachute and the car; F F are spikes fixed to the bottom of the car, so that when the parachute reaches the ground they will fix it and keep it from upsetting.

*To the Editor of the Penny Mechanic.*

SIR,—Since the accident to the late Mr. Cocking, the minds of many seem to have been turned towards a safety parachute. The object of all, as far as I am able to judge, appears to be to prevent a further sacrifice of human life; but in producing any new contrivance of this nature, we have to fear that we do not bring another victim into the field; and it is necessary to say, that whatever may come before the public in future of this kind, let no man step into it until it has been well tried with a weight equal to his own.

Garnerin's parachute, with all its defects, is the safest, and consequently the best that has yet been tried. With a view to remove the objections to it I have endeavoured (and I think not in vain) to unite the cone with the umbrella form, without adding materially to its weight, and also to ensure its opening immediately after it is set at liberty.

The models I have made are both simply the covers of the steeple-top parasol, with the top inverted, to form the cone in the centre; and a cord from it, a little

Digitized by Google

shorter than those at the extremity. In this form the parachute falls very steadily. I have repeatedly tried this model, by twisting the cords about it rather tightly, and throwing it thirty or forty feet high; it generally uncoils itself, expands, and falls gently and steadily to the ground, with about two ounces and a half attached to it.

As an additional security, I have placed a small cane hoop in one of them, which is intended to keep it partly open in ascending, and a convenience also to unite it to the balloon. And in the event of an experiment being made with this parachute, I would recommend that the balloon should be descending sufficiently to expand the parachute, previous to its being cut away, thereby procuring the most steady departure for the earth.

I remain Yours, respectfully,

L.

[A fuller description of this parachute will be given (with an engraving) when we shall again recur to the subject of aerostation.]

## ON THE STUDY OF MECHANICS.

NO. IV.

(*Continued from page* 98.)

[Some few of our copies were printed off last week, by mistake, with the head "Mechanics, No. 4," placed over a letter, signed "Q. E. D."

DEF. 6.—*Particles.*—By a particle of matter must be understood, a quantity so small that its size becomes imperceptible; so that the effects of its inertia and gravity may be calculated without considering its size; that is, it may be assumed as a mathematical point. When we speak of the number of particles contained in a body, it is always to be understood relatively; comparison being made with another body. No separation or alteration in the arrangement of the parts of a body produces any alteration in its aggregate inertia and gravity; therefore, for the convenience of expressing quantity by numbers, a body may be considered as made up of minute parts, each possessing the same inertia and gravity, without consideration of their individual density; hence the quantity of matter contained in one body is to the quantity of matter contained in another; as the number of particles contained in one is to the number of equivalent particles contained in the other. The quantity of matter contained in a *given body* may be estimated by its aggregate inertia, or aggregate gravity.

It is the opinion of some authors, that matter is composed of indivisible and immutable particles, called *atoms*; but as experiment gives no indication of their existence, and no rational argument is adduced in support of that hypothesis, we cannot even admit the *probability* of its truth. In a future paper it will be *demonstrated* that they do not exist.

DEF. 7.—*Density* is the quantity of matter which a body contains in a *given bulk*; it is said to be *uniform* when equal quantities of matter are always contained in equal bulks; and *unequal* when equal quantities of matter are *not* contained in every equal bulk.

DEF. 8.—*Motion* is the act of a body's changing its place. The velocity with which it moves is measured by the space uniformly described in a given time; when the velocity is *not uniform*, the velocity at a given point is measured by the space which would be described in a given time, if that velocity were continued uniform. Motion is of two kinds; absolute and relative. A body is in absolute motion when it changes its place, compared with a fixed point; all bodies on the surface of the earth partake of the earth's motion, and are consequently in absolute motion: indeed, every particle of matter within the scope of our observation, appears to be in a state of considerable absolute motion; but it is more convenient to consider bodies as in absolute motion, or absolute rest, according to their motion or quiescence, when compared with the *earth* as a fixed object. (It will be seen hereafter that the absolute motion of a system does not affect the relative motions of its parts.) A body is *relatively* in motion when it changes its position compared with another body *in motion*. When two bodies move in opposite directions, their relative velocity is the *sum* of their respective absolute velocities; if they move in the same direction, it is the *difference* of their absolute velocities; and if their absolute velocities are equal and in the same direction, they are relatively at rest. In all cases, the relative velocity of two bodies is the velocity with which they approach or recede from each other; and it is therefore equal in each body, whether both, or only one, be in absolute motion.

DEF. 9.—*Momentum* is the force with which a *given body*, moving with a *given velocity*, endeavours to proceed in the direction of its motion; it may be thus distinguished from *inertia*. Inertia is an inherent property of matter, invariable in

Digitized by Google

all places and in all circumstances; *momentum* depends upon the *quantity of motion*, that is, the quantity of matter in motion, and the velocity with which it moves; it is therefore measured by the velocity and quantity of matter jointly, as $V \times Q = M$.

DEF. 10.—*Compressibility* is that property by which a body cedes, or contracts its size, when acted upon by adequate pressure.

DEF. 11.—*Imperceptibility* is the capability which every particle of matter possesses of *altering its figure* when acted upon by an adequate force, without consideration of its absolute *compression*.

DEF. 12.—*Elasticity* is the tendency of a body to recover its former figure after being compressed, or impressed. A perfectly elastic body would recover its figure with a force equal to that employed in producing the compression, supposing the matter which is moved by compression to possess no inertia. *Specific elasticity* is the force with which a body of given dimension and figure endeavours to preserve or recover its original figure; thus the specific gravity of steel is greater than the specific elasticity of whalebone, &c.; and the specific gravity of all metals varies in different temperatures, decreasing as they approach to fusion. I observed, in a former paper, that erroneous definitions occasion considerable error in the calculations founded thereon, when they are adopted as axioms. The following example shows the impropriety of tolerating false definitions. Perfect elasticity is thus defined in the Cambridge Mechanics:—"*By a perfect elastic body we mean one which recovers its figure with a force equal to that which was employed in compressing it*," omitting the requisite qualification, "*supposing the matter moved by compression to possess no inertia.* This false definition is afterwards taken as an axiom, and produces this manifestly absurd result: "*In steel balls, the force of elasticity is to the compressing force as* 5 *to* 9; *in glass as* 15 *to* 16; *though in all cases the force of elasticity* seems *to depend, in some measure, upon the diameter of the ball.*" As far as experiment can penetrate, both glass and steel are perfectly elastic; that is, the force of elasticity is to the compressing force as 1 to 1. But it must be understood that the quantity of compression is to be limited according to their respective capabilities, and the force must be immediately removed when the compression is effected; otherwise a permanent impression may be produced. The cause of the error being so much greater in the steel ball than it is in the glass, is that the inertia of steel, compared with its specific elasticity, is proportionally greater. This question not only involves a philosophical truth, but materially affects the theory of mechanics in its practical application. I will, therefore explain it more explicitly by means of the following

PROPOSITION.

*If any force be made to act upon a perfectly-elastic body, so as to produce an impression, it will recover its former figure with a force equal to the impressing force, minus the inertia of the parts moved by the impression.*

Let F be the impressing force, E the elastic force, and X the inertia of the parts moved. Part of F will be expended upon X, and the remainder upon E; or the whole effect upon E will be $F - X$; but the force transferred from F to X will, at the end of the impression, be absorbed by E; therefore the whole effective force upon E will be $F - X + X = F = E$; and in the reaction of E its force will be partly expended upon X, and the remainder will be effective upon F; so that $E - X = F - X$ will be the momentum communicated to F when the body has recovered its former figure. The remaining force X will act in the contrary direction to E, and cause it to protrude until it has absorbed the whole momentum of X: the protruded matter will then return and produce another impression; and if not acted upon by external resistance, a continual series of vibrations will be produced: this is the cause of the vibration of all sonorous bodies.

It will be proper to observe, that in the foregoing proposition F, E, and X are supposed to act in the same, or opposite direction; to describe the effects in bodies of various figures, where the elastic force *seems* to vary, would exceed the limits of an incidental remark; but it will be explained upon some future occasion.

Q. E. D.

## HEAT.

NO. II.

(*Continued from page* 108.)

ALL heated bodies, when exposed to the air lose portions of their heat by projection, in right lines, into space, from all parts of their surfaces: this we denominate radiation. The term radiant heat, or heat flying off like light, in rays, originated with Scheet. It is so familiar to every one, that I think I need not adduce any experiment to illustrate it. Our com-

Digitized by Google

mon fire-places furnish an admirable illustration of this property of heated matter; nearly all the heat which we derive from the burning coals is furnished by radiation. Different substances, as we might naturally conclude, project or radiate heat in different quantities; and the nature of their surfaces also greatly influences their powers of radiation. Mr. Leslie made a valuable series of experiments to ascertain the radiating power of different bodies, and the following table exhibits the conclusions which that distinguished philosopher arrived at, with respect to the radiating power of different substances in atmospheric air:—

| | |
|---|---|
| Lampblack ..... | 100 |
| Writing-paper ..... | 98 |
| Crown glass ..... | 90 |
| Ice ..... | 85 |
| Isinglass ..... | 75 |
| Tarnished lead ..... | 45 |
| Clean lead ..... | 19 |
| Tin plate ..... | 12 |

From the above table, it appears that any thing which tarnishes the surface of metal increases its radiating power; thus we find that tarnished lead is a much better radiator than clean lead.

Vessels intended to contain a liquid at a higher temperature than the surrounding air, and to keep that liquid as long as possible at the higher temperature, should be constructed of the worst radiators of heat; thus, a bright metal tea-pot is best adapted for the purpose, whereas a black porcelain tea-pot is the worst conceivable material for that vessel.

A certain quality is possessed by all bodies, by which heat passes through their dimensions; this property is called conduction; and, as in the case of radiation, they arrange themselves under the heads of good and bad conductors, thus is the transmission of heat effected less speedily in some than in others. Procure a solid cylindrical piece of iron, of about an inch in diameter, and one of wood, of the same size, and having wrapped a piece of paper round each in close contact with their surfaces, hold them over a candle; the paper affixed to the wood will soon be burnt through, but that in contact with the metal will be hardly affected by the heat. The cause of this is, that the metal being a good conductor, continued to absorb the heat as fast as it was imparted to the paper, and so preserved it from being burnt; whereas the wood, being a bad conductor, suffered the heat to accumulate in the paper affixed to it, and thereby caused its destruction.

All kinds of earthy matter are bad conductors of heat. It is said that the red hot balls used at Gibraltar in repelling the attacks of the Spaniards, were conveyed in wooden wheelbarrows from the furnaces to the bastions, having only a layer of sand between them.

A very pleasing experiment may be made by the student, to show the bad conducting power of water downwards; procure a glass tube, about 14 or 15 inches long, and about half an inch in diameter, fill it about three parts full with water; by holding it in an inclined position, and applying the flame of a candle about its middle, the water may be boiled in the upper part of the tube, while that situated in the lower part will be quite cold.

SCIOLISTERUS.

*To the Editor of the* PENNY MECHANIC.

SIR,—In consequence of one of your Correspondents having sent you a description of a Self-acting machine, which you have promised to insert in your useful Magazine, I beg leave to state, that I have one, which I planned some time ago. My object in sending this letter is to prevent any dispute arising, if his plan should happen to be the same as mine. It is intended for a clock, to be kept in motion as long as it will wear or last, by a moving power, purely mechanical, consisting of two lever wheels, to move of their own accord, by means of weights at the end of each lever, and the levers sliding in and out the wheels, keeps the clock in motion.

I remain your humble servant,

S. W.

## ECLIPSES.

*To the Editor of the* PENNY MECHANIC.

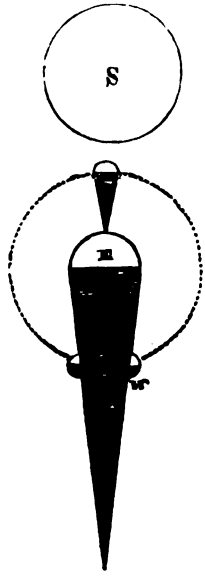
SIR,—The greater number of your readers are doubtless acquainted with the nature of an eclipse; but to many who have not an opportunity of studying such matters, a brief explanation of that phenomenon may be interesting, attention being naturally attracted to the subject by the total eclipse of the moon which we had an opportunity of observing on the night of the 13th ult.

The exact laws of the motions upon which the calculations of an eclipse are founded cannot be described without entering deeply into astronomy; but a general idea may be formed without consideration of these minutiæ or their causes.

Besides the *apparent* diurnal motion of the moon from east to west, caused by the rotation of the earth about its axis, it has a *real* motion, by which it performs a com-

Digitized by Google

plete revolution round the earth every month; this motion occasions both the solar and lunar eclipses.




Let S be the sun, E the earth, M m the moon, shown in two opposite places in its orbit. When the moon is at the point M, it is in a right line between the sun and the earth; but being smaller than the earth, and much smaller than the sun, its shadow darkens only a small part of the earth; the eclipse is consequently invisible except in the places where the shadow falls. If the *centre* of the shadow fall upon the earth, there is a *total* eclipse of the sun to a spectator placed at that point; when the shadow does not reach so far as the earth, the eclipse is anular, exhibiting a ring of light, when the centre of the moon is in a right line from the spectator, to the centre of the sun. If only *a part* of the moon intervene, the eclipse is partial. The variations which occur in the apparent diameters of the sun and moon is owing to their distances from the earth varying at different periods. The sun being on the opposite side of the moon from the spectator, it cannot illuminate any of that part which is visible to us; therefore a solar eclipse can only occur when the moon is at the change.

At m the moon is represented at the opposite side of its orbit, in three different positions of a total eclipse of the *moon*. The dark disc in the centre is the moon totally eclipsed, being so situated that the earth intervenes and intercepts the light of the sun. Here the *earth* being the larger of the two bodies, its shadow obscures the whole disc of the moon when the centre of the moon passes through the centre of the earth's shadow. When the centre of the moon does *not* pass through or near the centre of the shadow, the eclipse is partial. When the moon is eclipsed, it is seen *alike* from all parts of the earth where it is above the horizon. Since the sun and earth are on the same side of the moon, its visible disc must be entirely illuminated immediately before and after the eclipse; that is, when the is eclipsed it must be at the full.

Although the earth totally intercepts the *direct* rays of the sun, a small portion of light is thrown on the obscured surface of the moon, by the refraction of the earth's atmosphere, which causes the rays to deviate from a right line in the same manner as is observed in the prism, or an object immersed in water, and viewed obliquely through the surface. In a very clear atmosphere the moon appears red during the eclipse; it resembles the colour of the sun seen through a thick London fog;—a phenomenon more frequent than agreeable in this part of the world. If a spectator could be placed in the moon, the aspect of an eclipse would be widely different; when we see the sun eclipsed, he would see the small circular shadow of the moon pass over the broad disc of the earth, which would appear as a *moon* to him, but three or four times larger in diameter. In a total and central eclipse of the moon, he would see the dark orb of the earth pass before the sun, presenting the appearance of a large black disc, surrounded with a deep red halo of refracted light; while the heavens, from the horizon to the zenith, would be blazing with myriads of stars, darting their unsullied light through the cloudless regions of space—a magnificent and glorious spectacle, but one which imagination only can contemplate.

Accept, Mr. Editor, the assurance of my respectful consideration towards yourself and *all* readers,

Q. E. D.

The most powerful locomotive engine yet made has just been completed by Mr. Stephenson. Its propelling wheels are seven feet in diameter, and it is capable of dragging fifty tons. It is intended to run on the Great Western Railway.

Digitized by Google

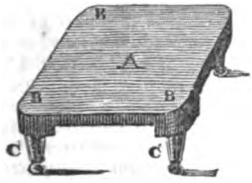
# THE CHEMIST.

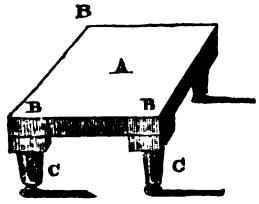
## ELECTRICAL STOOL.

*To the Editor of the* PENNY MECHANIC.

SIR,—I have lately discovered a very cheap method of making the Stool generally used in experiments with the electrical machine. It is as follows :—

Take a piece of deal, about eighteen inches long, fourteen inches broad, and one inch thick; let it be planed very smooth on both sides, and have the edges and corners rounded. To the under side at each corner glue a piece of the same sort of wood, four inches square, and one inch thick. When the glue is quite dry, let there be a hole bored through the centre of each of the square pieces, and wide enough to admit the bottom of the neck of a common quart bottle. Then take four quart bottles, and having knocked or cut off the necks of the shoulders, let the bottom of each neck be firmly cemented into each of the four holes. A cement well adapted for this purpose is described in No. 9 of your valuable Magazine, but which would be much improved by the addition of one part more bees-wax, and two parts of powdered red-ochre.




The subjoined figures represent the stool complete. A the top of the stool; B B B three of the square pieces of wood glued on to the corners (the fourth being invisible in the drawing); C C C three of the necks of the bottles.

With this stool many very interesting experiments may be performed, of which the following are a few :—

1st. Let a person stand on the stool, and with *one* hand take hold of the conductor of the electrical machine, while in action; sparks may now be drawn from any part of his body as easily as from the conductor itself.

2nd. While he still remains on the stool, let some person approach him with a warm spoon, containing a few drops of ether. If he now bring one of the knuckles of his *other* hand within a quarter of an inch of the ether, a brilliant spark will issue from it, and will ignite the ether.

3rd. Perhaps the most amusing experiment that can be performed by the aid of the electrical stool, is called the "electrical kiss." It is as foHows:—Let any lady challenge a gentleman, not acquainted with the experiment, that he will not be able to kiss her, although she may incline to meet him. If he accept the challenge let her mount the stool, and while they are inclining their heads to kiss each other, turn the machinery briskly. Provided their clothes do not touch before their lips meet, a spark of fire will fly from the lady to the gentleman, which will be sure to make him draw back, without accomplishing his design.

N.B. In all experiments with the electrical stool, care must be taken that the clothes of the person standing on the stool do not touch the table, or any other surrounding object, which would convey the electricity back to the ground as fast as it was excited in the machine.

Your's truly,

*Fleet-street.* J. G.

## CHEMICAL TESTS, OR RE-AGENTS.

***To produce a beautiful Crimson Liquid by mixing a Blue one and a Colourless one.***—To a mixture of a tea-spoonful of tincture of cabbage, with a glassful of water, add a few drops of sulphuric or muriatic acid; upon which the blue colour given by the tincture will be changed to a red.—This is designed to show the influence of acids in changing vegetable colours. If a red colour is produced by dropping a little tincture of cabbage into a certain solution, we know that that solution contains an acid; and if the reddened solution, upon being heated, becomes blue, we learn that the acid is either carbonic acid or sulphuretted hydrogen, as only those two acids are volatile.

***Test for Muriatic Acid.***—Add a drop of muriatic acid to a quart of water; pour some of the mixture into a test-glass, and let fall into it a single drop of nitrate of silver; the whole will instantly be pervaded by a milkyness, as the muriatic acid combines with the silver and form

Digitized by Google

muriate of silver, a salt highly insoluble. So great is the power of this test, that if a single grain of common salt is dissolved in 42,250 grains of water, the muriatic acid, though amounting to only 1,108,333 parts of the weight of the solution, is detected.

*Southwark Astronomical Society*, Nelson-street, Long-lane.—On Friday, Nov. 17, at eight o'clock precisely, Mr. Maugham will deliver a lecture on Heat.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—Can any of your very ingenious readers inform me of the most modern construction of the interior of a percussion gun? Also, of the inside of a Parker's patent fountain lamp?

EUGENIUS.

Sir,—Can any of your Correspondents inform me what are the colours used for painting objects on magic lanthorn slides, where I can purchase them at the cheapest rate, and the most simple method of drawing the objects fit to illustrate astronomy, natural history, &c.?

Also, the best and simplest method of constructing a Phantasmagoria?

J. M. R.

## ANSWERS TO QUERIES.

"Experimenter." No. 49 of our Magazine contains an article on amusing experiments with the air pump.——He can purchase a camera obscura for half-a-crown, which he had better do than attempt at making one.

Sir,—If your Correspondent, "Pivott," should find the following preparation of any service to him, my aim in sending it will be fully answered.

Several years ago, Monsieur Chevreul discovered that all fat is composed of two distinct substances, one of which, called *elain*, remains fluid at the ordinary temperature of the atmosphere; and the other, denominated *stearine*, easily becomes solid. The former should be used for all instruments of a delicate nature to which oil is applied to prevent friction. It is obtained thus:—Oil, or fat, is exposed to the action of eight times its weight of alcohol, nearly boiling; the liquid is then poured off, and on cooling, the stearine separates in a crystalline form. The alcohol is then evaporated to a fifth part of the volume of the whole, and the elain remains, which is colourless, insipid, without smell, and difficult to congeal.

Or by squeezing tallow between the folds of porous paper, the elain is separated, and soaks into the paper, while the stearine remains behind. The paper being soaked in water, and pressed, gives up the elain.

I remain yours, EUGENIUS.

*Moulds for Casting Leaden Figures.*—If "T. E." has models to cast from, he will find plaster of Paris best suited to his purpose. Many persons cut their moulds out on hearth-stone.

No. 52. "R. W." *Why are Conical Wheels more generally used than Cylindrical ones?*—Cylindrical wheels, placed as they usually are, obliquely, present many disadvantages; the carriage is more easily overturned, because the points of support are brought nearer to the centre of gravity; the friction on the axle increased, by the wheel acting as a lever; and a greater force is required to draw the carriage, owing to the friction of the wheel on the ground; the greater and lesser circumferences describing the rectilinear space. I am not aware that any valid reason is assigned for the adoption of so extraordinary a construction, unless it be that the wheels, being wider apart, would be inconvenient on some particular roads.

Q. E. D.

"A Young Tradesman." *How is the quality of Steel in Manufactured Goods to be ascertained?*—The quality of steel cannot be ascertained unless you make the sacrifice of an article as a sample; if a file, or any cutting instrument, try it upon the hardest substance it will cut without indenting or breaking the edge, and compare its capability with a similar instrument of known quality. Other things may be examined, by observing the fracture, when broken, but this requires experience. The degree of hardness may of course be found by filing; but the surest method of knowing the quality of hardware is (with reverence be it spoken) the same which must be employed to find out the true quality of *soft-ware*) namely, by trial.

Q. E. D.

[Some physicians, from long practice and very keen perception, can read a patient's disorder in the countenance. So it is with some persons who deal largely in cutlery; they can judge of the quality from the colour of the steel. The common cast-iron cutlery, for instance, has a reddish-brown tinge, while fine steel has been polished so high as to answer the purpose of a mirror.]

"F. F. D." Marble is polished with a white powder called putty (I believe it is an oxide of tin.)

## TO CORRESPONDENTS.

*If J. J. will send his address to* W. Syrett, *No. 27, Great Titchfield-street, Oxford-street, he will receive the information he requires respecting the Watch Alarum.*

*The communication from* T. M. Vaughan, Bristol, *is favourably received.*

J. G.'s *paper on the Steam Gun shall be inserted next week if possible.*

Sciolisteros. *The drawing of the Oxy-hydrogen Microscope is sent to our engraver.*

*The letter on Strikes, sent by* J. F. S., *must stand over for the present.*

J. Franklin's *Safety-valve is a very clever contrivance, and his description of it shall be inserted when the engraving is executed*——*We have had several models of apparatus for Sweeping Chimneys sent us. We intend inserting a description of one next week, which, we think, will entirely supersede climbing boys.*

W. J., Brighton, *shall be inserted.*

*Received* T. Matthews—J. M.—W. S., &c.

## ERRATA.

In page 108, 13th line on Heat, the apostrophes ought to have been deleted, the quotation extends to the end of the paragraph.

In No. 52, page 98, col. 1, line 3, for "of the" read *and*; line 23, for "invention" read *extension*.

In No. 50, page 80, col. 1, line 31, for "pound" read *hour*.

Long-looked-for come at last!—A Magazine for the Boys!!

Just published, with neat Engravings, price One Penny, a new Weekly Periodical, entitled,

THE MAGAZINE FOR ALL THE BOYS; HOLIDAY COMPANION; and GENERAL STORY-TELLER.—The Book, instead of its Editor, will join them in all their amusements; though grave in the School-room, it will be a most cheerful associate in the Play-ground: will join them either at Cricket, or Marbles, or Leap-frog, or what they please. It will accompany them in their Fishing Excursions; make one of their Bathing Party: or seek with them the Bird's-nest. And when the setting sun reminds them of home, it will follow them thither, and in the social circle have many a pleasant Tale to tell.

London: G. Berger, Holywell-street; D. Doudney, Holloway; and all Booksellers.

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LVI.] SATURDAY, NOVEMBER 18, 1837. [Vol. II.


### GOTHIC AND ELLIPTIC ARCHES.

FIG. I.

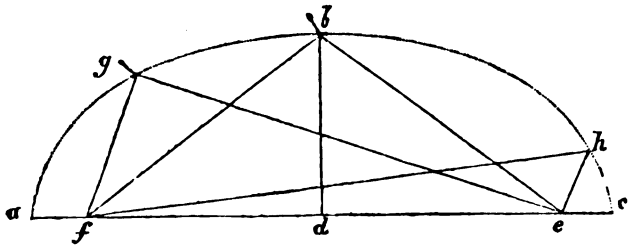



FIG. II.

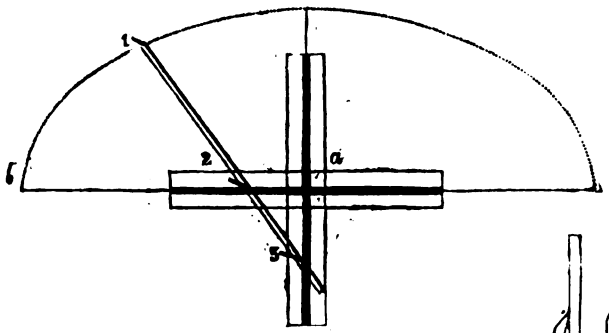
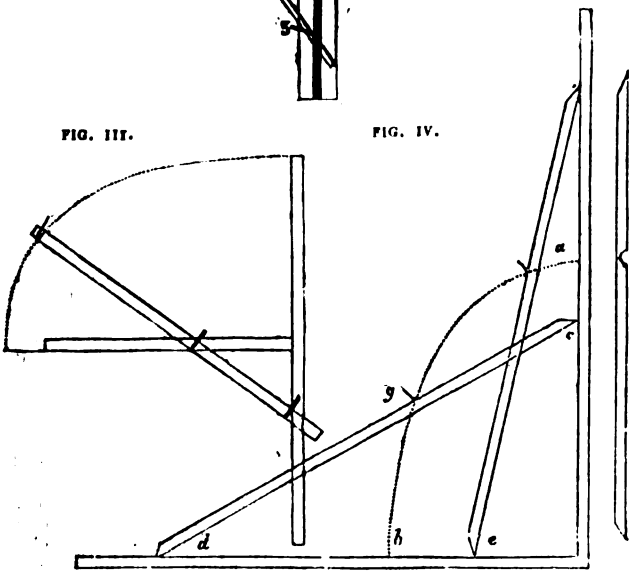



FIG. III.

FIG. IV.







Holloway Press: D. A. Doudney.



Digitized by Google

I beg our friend will not defer sending his parachute on my account, especially as we are about to be regaled with a fresh batch; and I have no "wonder workings" and "aboriginal ideas" to offer him, as he expects. I hope his next communication will be upon a more interesting subject, and influenced by a more benignant planet.

I remain, sir,

Your "ungenerous, vain, modest, ill-natured, pompous, wonder-working, disrespectful, sensible, sneering, consistent, hypercritical, aboriginal, indigestible" servant,

Q. E. D.

*To the Editor of the* PENNY MECHANIC.

SIR,—A correspondent in your last Number, who rejoices in the cognomen of "Alexis," is certainly a very strange sort of personage. After saying, in the first part of his letter, "I have always maintained a respect for *The Penny Mechanic* (if I may be allowed the term) grounded upon the perfect equanimity of temper which your able correspondents have displayed," he falls foul, in no very polite terms, of your able correspondent, "Q. E. D." Had he confined his remarks to him I should have had no fears as to the result, he being very well able to take care of himself. I have, however, a few words to say on another part of the letter. "Alexis" says, "the *ungenerous fling* at *Sir Andrew Agnew* would have been much better omitted; for however misled he may have been, no person can deny but that his motives were good." The motives of the worthy Bart. may be very good of the sort; I shall not therefore quarrel with them. But from the above-quoted passage, it would seem that "Alexis" dislikes an ungenerous fling; therefore he says, "Had he, instead of his name, introduced that of the *greatest humbug* of the age, D. O'Connell, he would have done much better." I should like very much to know from "Alexis" what right or title he has to call the hon. member for Dublin "the greatest humbug of the age." I say that Mr. O'Connell is no humbug, but that, on the contrary, he is one of the greatest patriots and statesmen of the age; added to which he is the friend of the working man. I will conclude this hasty note, by remarking, for the information of "Alexis," that the name of O'Connell will live in the hearts of millions of his countrymen long after his mortal remains shall have been laid in the dust, and when party virulence shall have ceased to attack him.

I am Sir, yours, &c.

J. F. S.

## SOUTHWARK OBSERVATORY,

*Nelson-street, Long-lane.*

ON the first establishment of this Institution, two years ago, it embraced only the opportunity of having access to the 30-ft. refracting telescope, intended to carry three series of lenses, and at present fitted up with one. Courses of lectures and a reading-room have since been added; and it is the object of the founders to render the means as interesting, and the ends as instructive and useful as those of any Society at present existing.

The whole undertaking was commenced and continues at the responsibility and sole expense of the Treasurer.

We hope the patriotic exertions of this individual may prove a national benefit, and source of gratification to himself; that through the means here offered for studying the delightful science of astronomy, the genius of some of our countrymen may be made to shine forth and spread a lustre on our nation.

The distinguishing feature of this Society consists in the possession of an extensive apparatus, designed to carry three powerful refracting telescopes, having a focal distance of thirty feet, yet so manageable as to be easily adjusted, by a single person, to any point in the heavens.

For the purpose of displaying to the public the object which the founders hold the more particularly in view, it was at first deemed advisable to announce courses of lectures on astronomy, or on subjects only that are intimately connected with it; this having been accomplished, the Committe have now the satisfaction of presenting a list of lectures, which, from their being more diversified, will, they doubt not, be esteemed more interesting by the generality of the members.

The Committee feel great pleasure in acknowledging the assistance proffered by several gentlemen of talent, in furtherance of the objects of the Institution.

The Reading Room is supplied with periodicals, and with a selection of works on scientific and general subjects. It is also furnished with globes, maps on various projections, tracing globes, apparatus, drawings, specimens, &c.

The privilege to visitors of admission to the observatory has been extended to the lectures; and in order to accommodate

Digitized by Google

occasional residents in London, to whom the opportunity of frequently attending the Institution during their stay would be highly desirable, a regulation has been adopted, by which, on payment of a trifling sum, visitors can be admitted to the observatory on five distinct evenings, and to one lecture.

To those who seek for rational gratification in the cultivation of intellectual and scientific pursuits, the Committee now address themselves, soliciting their support, by becoming subscribers to this truly national undertaking.

On Friday, November the 10th, an Introductory Lecture, on the Properties of Matter, will be delivered by W. Maugham, Esq., Lecturer to the Gallery of Practical Science, Belgrave Institution, &c. Admission by tickets, which may be obtained gratuitously on application. To be followed every succeeding Friday by popular lectures on astronomy and the various departments of physical science.

Terms of subscription for the use of the observatory and reading-room, and attendance at the lectures:

| | Per Ann. |
|---|---|
| A lady (ticket not transferable) | £1 1 0 |
| A gentleman, ditto | 1 11 6 |
| A lady or gentleman (one personal and one transferable admission) | 2 2 0 |
| Every additional transferable admission | 0 12 0 |

Terms for the admission of visitors, on entry of name and address, and compliance with the regulations of the Society:

| | |
|---|---|
| To the observatory, any evening (except Friday) | 1 0 |
| To the observatory five evenings and to one lecture | 2 6 |

Tickets for any particular lecture, one shilling each, may be procured any day previous to that of the lecture. Terms may be agreed on for the admission of societies, schools, &c.

All applications to be made at the Observatory, or to the Hon. Secretary, 6, Dean-street, Tooley-street.

## DAMASCUS STEEL.

The composition of the material formerly so celebrated as the steel of Damascus has given rise to many investigations, not merely on the point as to whether it was indebted for its appearance and elasticity to welded laminæ of iron and steel, or to some chemical peculiarity, but likewise whether a large proportion of the notions connected with its history and excellence may not have been fabulous. The most general opinion has been, that the variegated surface of oriental sabres results from their being composed of what the French call *étoffé*, or mixed metal; that is to say, a compound of bars or wires of steel, or of iron and steel, welded and wrought together, and twisted in different directions. In 1823, the Repertory of Arts published the translation of a paper, giving the result of a series of experiments undertaken by M. Bréant, examiner general of the assays at the Royal Mint in Paris. The French philosopher comes to the conclusion, that, instead of a mere mixture of metals, the oriental damask is in reality a cast steel, more charged with carbon than our European steels, and in which, by the effect of cooling, properly managed, a crystallisation is produced of two distinct combinations of iron and carbon. M. Bréant premises that the law discovered by Berzelius, according to which bodies combine that have any affinity for each other, explains, in a satisfactory manner, the property which characterises the steel of the orientals of becoming variegated at the surface, when, after being polished, it is submitted to the action of very weak acid. "Let us suppose," says the investigator, "that in the preparation of steel sufficient carbon have not entered, the steel formed will only be in proportion to the quantity of combined carbon; the rest will be iron, only mixed. The cooling then taking place slowly, the more fusible particles of steel will tend to unite together, and separate themselves from the portion of iron. This alloy will therefore be capable of developing a damask; but this damask will be white, but slightly marked, and the metal will not be susceptible of great hardness, because it will be mixed with iron.

"If the proportion of carbon be exactly such as it ought to be, in order to convert the whole of the iron into steel, there will be only one sort of combination: but if the carbon is a little in excess, the whole of the iron will be in the first place converted into steel. Afterward the carbon remaining in the crucible will combine in a new proportion with the part of the steel already formed. There will, in this case, be two distinct compounds, namely, pure steel and carburetted steel, or cast iron. These two compounds, at first mixed confusedly, will tend to separate when the liquid matter remains at rest. A crystallisation will then form, in which the particles of the two compounds will arrange themselves, according to their

Digitized by Google

respective affinity or their specific gravity. Let a blade, made of steel, thus prepared, be put into acidulated water, a very apparent damask will be developed, in which the pure steel parts will be black, and those of carburetted steel will remain white, because the acidulated water does not so easily show the carbon of the carburetted steel. The carbon irregularly dispersed in the metal, and forming two distinct combinations, is then that which occasions the damask; and it is obvious that the slower the cooling the larger the damask veins should be. For this reason it is, perhaps, necessary to avoid melting very considerable masses, or rather it will be requisite to make some modification in the process. In support of this opinion, I think I should quote Tavernier, who, in his Travels in Persia, has given some information which makes us acquainted with the size of the lumps of steel, which, in his time, were employed in making the damask blades: 'The steel susceptible of being damasked,' says he, 'comes from the kingdom of Golconda. It is met with in commerce in lumps about the size of a halfpenny cake. They are cut in two, in order to see whether they are of good quality or not, and each half makes the blade of a sabre.' From this account it is evident that the Golconda steel was in buttons, like *wootz*. Tavernier adds, that if, in the hardening of that steel, the methods of Europe were followed, it would break like glass. Hence it may be inferred that it is very difficult to forge, and so it was observed by Réaumur.

"This philosopher having received from Cairo some specimens of Indian steel, found nobody in Paris able to forge them. On this subject, he declares that it must be the fault of our workmen, for the orientals succeed in working this kind of steel. As carbon has the principal influence, not only upon the damask of the steel, but also on its intrinsic qualities, it is to be feared that Messrs. Stodart and Faraday may have been led into error in their labour, as I have been myself for a long time, and that they may have attributed to metallic alloys effects more particularly due to a greater proportion of carbon. I am, however, very far from contesting the existence of metallic alloys in the oriental sabres, although, in the few fragments that I have had occasion to analyse, I have found neither silver, gold, palladium, nor rhodium. It appears to me, nevertheless, very probable that various combinations may have been attempted.

"Plumbago has appeared to me, in some circumstances, to soften the steel, which an excess of carbon would render too harsh; at least, I have obtained excellent results with a hundred parts of steel, one of smoke-black and one of plumbago. But a very remarkable experiment, in regard to the advantage which may be derived from it, in working on a large scale, is, that a hundred parts of soft iron and two of smoke-black, melt as easily as common steel. It must be supposed that the whole of the carbon does not enter into combination. Some of our best blades are the product of this combination. It is evident from this experiment that it is not necessary, in order to obtain very good steel, to begin the operation by cementing iron. The iron may be treated immediately with the smoke-black, and this would greatly diminish the expense of the manufacture.

"A hundred parts of the filings of very grey cast iron, and a hundred parts of similar filings, previously oxydised, have produced a steel of a fine damask, and fit for the manufacture of bright arms. It is remarkable for its elasticity, a valuable quality not possessed by the Indian steel. The more carbon the steel contains, the more difficult it is to forge. Most of the specimens that I have prepared have not been drawn out but at a temperature, the limits of which are very confined. Heated to white-red they crumble under the hammer. At a cherry-red heat they become hard and brittle, and that disposition increases in proportion to the fall in temperature, so that once arrived below cherry-red, if we would remove a portion with a graver or file, they are found to be much harder and more brittle than after they are completely cooled.

"I am convinced, by experience, that the orbicular veins, called *ronces* by the workmen, which are seen on the fine oriental blades, are the result of the manner of forging. If we content ourselves with drawing the steel out lengthwise, the veins will be longitudinal. If we extend it equally in all directions, the damask has a crystalline appearance. If we render it wavy in the two directions, there will be shades and gradations, as in the oriental damask. It will not require long trials to be able to produce any variegated design we desire."—*Lardner's Cabinet Cyclopædia.*

We learn from a Portsmouth paper, that a lady, who has recently died, has left the sum of 200*l.*, to be given as a reward to any person who shall invent a machine which will supersede the use of boys in sweeping chimneys.

Digitized by Google

# THE CHEMIST.

## EXPERIMENTS IN ELECTRICITY.

Fig. 1, of the engravings in our front page, represents the Electric Sportsman. A is a stand of wood; B is a common Leyden jar, out of which proceed the wires H, one terminating in the ball F, the other in the ball D; surrounding which are small birds made of pith and feather, suspended to the ball D by silken threads; E a shelf for the birds to rest upon; C a sportsman; G his gun. The Leyden jar should be filled with electricity, and the birds will then fly round the ball. It should be then placed on the stand, and the sportsman's gun brought in contact with the ball F; a report will be heard, and the birds will fall as if dead. There should be a communication between the vial and the sportsman of metallic substances, as seen by the dotted line on the stand.

Fig. 2 is a representation of the Electric Bells. A is a glass pillar, fixed in a stand of wood, from the top of which proceed the wires D, terminating by two bells B, hung by a chain; C silken threads, terminating in brass balls. The electrical apparatus is then attached to the ball E; tongues C will then verberate against the bells. The middle bell is to have a hole at the top for the glass pillar to pass through. This will have a very pretty effect; the etectricity passes down the wire D to the bell, it then attracts the clapper, which, when loaded, it repels, to discharge itself against the middle one, and again returns. The bottom of the pillar should be coated with tin-foil from the bell downward.

Fig. 3 is the Wheel. A is a wire, to be placed on the conductor of the electrical apparatus; the wires B B B B to be bent round and terminate in a fine point. The wheel will turn round upon its axis at C.

WIGO.

---

*Method of preparing and using a Fulminating Powder.*—Take three parts of nitrate of potass, two parts of sub-carbonate of potass, and one part of sulphur; powder them separately, and dry them, by placing them on a tile before the fire; then mix them intimately, by rubbing all together in a warm mortar, and preserve the compound in a corked phial. Let half a drachm of this powder be spread on the bottom of a small iron ladle, and heated over a fire, it gradually blackens, and at last melts; at the same time it explodes with a violent report. It is not attended, however, with any danger.

*Fire produced by the mixture of two cold Liquids.*—Into a gallipot, placed on the hearth, pour three teaspoonsfull of oil of turpentine; then mix in a phial three teaspoonsfull of fuming nitrous acid, with one-fourth part of sulphuric acid; and pour this mixture suddenly upon the oil of turpentine; inflammation instantly takes place, accompanied by a large quantity of black smoke. It is advisable to fix the phial, from which the acid is poured, to the end of a long stick, as the sudden combustion occasions a part of the liquid to be thrown out of the vessel.

W. H. S.

*Cheap Pneumatic Trough.*—Obtain the half of a butter-tub, which can be purchased at any cheesemonger's for, at most, fourpence; then get a piece of deal, or any other wood, and burn two or three holes in it of a sufficient size for the shelf. Nail it inside the tub, about an inch below the intended surface of the water. Altogether the expense will not exceed sixpence. If available, it will be advisable to paint the tub, which will make it water-tight.

C. P.

*Very singular property of Camphor.*—If a small piece of camphor is placed on the surface of water contained in a basin, it immediately begins to move round and round with considerable rapidity. It is necessary that the water be pure, for if dust or grease be present the camphor will not move; or if, while its rotary motion is proceeding, a single drop of grease be let fall into the water, the camphor will instantly start away from it to the sides of the basin, and its motion will be put a stop to.—Nothing satisfactory has yet been advanced in explanation of this phenomenon.

*To show that the Atmosphere contains Water even in the driest weather.*—1. Expose to the open air for a few days a spoonful of dry sub-carbonate of potass, or muriate of lime, spread on a saucer; the salt will attract so much moisture from the air that it will become liquid. 2. Put a given quantity of strong sulphuric acid into a vessel exposed to the air; at the expiration of twenty-four hours its weight will be found to have increased one-third.

*To show that the Atmosphere contains Carbonic Acid.*—Expose to the open air, in an open vessel, a quantity of transparent lime-water; a white crust will soon form on its surface, which, on being broken, falls to the bottom of the vessel, and is succeeded by another. This preci-

Digitized by Google

pitate, upon being examined, proves to be carbonate of lime. Therefore carbonic acid is attracted from the atmosphere by the lime in solution. J. R. WATTS.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—I should feel obliged if "J." or any of your Correspondents who have made the air-pump described by him in No. 47 of your valuable periodical, would take the trouble to explain more clearly how the stop-cock is fixed into the cylinder, and which way it is placed in it, and by what outlet the air escapes, also how deep the cylinder must be let into the wood, and if there need be an air cushion.

Perhaps some of your Correspondents can inform me of some simple experiments that can be performed with the Cheap Electrical Apparatus.

Yours, &c., MERCURY.

Will Mr. Watts have the kindness to inform a lady how Court Sticking Plaister is made? The experiments resorted to have produced too brittle a sort. Also the method of preparing Cakes of Water Colours for drawing.

Sir,—Can any of your intelligent Correspondents inform me how to procure Pure Vegetable Oil, fitted for watches, &c.? PIVOT.

Sir,—Can any of the curious readers of your clever little work explain how a piece of card, in the form of a parallelogram, of two inches in length, by one and an eighth in breadth, may be cut in two, so that by placing one of the parts so divided in another position, it will form, together with its companion, a perfect square? This can be done, but by what calculation?

A. Z.

Sir,—Can any of your numerous Correspondents inform me how to construct or procure an Electrophorus, suited for a chemical laboratory? Also how to construct Electrical Apparatus, suitable to the Cheap Electrical Machines set forth in your valuable Magazine; such as Leyden Jars, pair of Directors, Luminous Conductor, Electrometers, Exhausted Flask, Discharging Rod, &c. A SUBSCRIBER.

[The postage of this letter was not paid.]

Dear Sir,—You will oblige me by giving insertion to the following queries:—

1. In what manner does steam produce the white deposit, or colour on funnels of steam-vessels, when in passing from the steam-pipes it plays on them?

2. We know that iron at a red heat possesses the property of decomposing steam, by combining with its oxygen, the hydrogen being set free; and we are also aware that this oxide of iron, at a red heat, can be restored to its metallic state, by passing hydrogen over it. Will some of your Correspondents be kind enough to explain this paradox?

3. Where can Coal Oil be purchased? If not sold, how can it be separated from gas tar?

4. By what means does Light decompose Nitrate of Silver, and how do the sun's rays effect the combination of a mixture of Chlorine and Hydrogen?

Yours, &c., W. Y.

## ANSWERS TO QUERIES.

"A Young Chemist" can purchase the Bottle and Tube, with screws to fit, air-tight, one within the other; also a piece of flexible metal tube (which can be bent to any shape, to convey the gas to the receiver), at Dymonds', operative chemists, No. 146, Holborn Bars, for 8s.—Also at Midgley's, 49, Strand; where he can obtain a Gas Bottle and Iron Tube ground in, together with a Flexible Metallic Tube, to suit the collection of gas, either by a gasometer or a pneumatic trough. The price will be 11s.

*Washable Varnish.*—This may be made by dissolving shell-lac in strong spirits of wine.

*Japan for Tin.*—Take of good linseed oil one gallon, and of umber half a pound; boil them together till the oil becomes very brown and thick; strain it through a coarse cloth, and set it again to boil, in which state it must be continued till it acquires a pitchy consistence, when it will be fit for use.

"W. S."—Common linseed oil, rendered very drying by being boiled with litharge, will, when applied to the tissue paper, and dried, by being placed near the fire, in the sun, or in any warm situation, (which precaution will be necessary to ensure its drying within the term of two or three days at furthest), fully answers the purpose for which it is intended, viz. that of rendering the balloon air-tight.

With regard to sticking the edges of the gores together, the best cement that can be used is a mixture of common glue and oil, melted carefully together without water.

As to inflating, carburetted hydrogen will not answer for a smaller balloon than one of twenty feet in circumference.

"Pickwick" will find the linseed oil much better suited to varnishing his balloon than any solution of Indian rubber. I am yours, &c. CARBON.

"A Schoolboy" will find some amusing Christmas Experiments in Number 8.

## TO CORRESPONDENTS.

*Does* A. Hewitt *think the model he made five years ago has been seen and taken advantage of by the persons who have now patented and brought it out as their own invention? Perhaps he can let us know his opinion by Monday next. To give publicity to the inventions of Mechanics, and to afford protection to their genius is the main object of this publication.*

"C. Taylor." *We intend shortly to give a description of the most approved Locomotive Engines at present in use on Railways.*

*The article sent us by* "Entity" *shall be inserted.*

*The attempt at perpetual motion, or rather the locomotive machine, of which our Correspondent has sent us a drawing and description, is not void of interest. We have sent the sketch to our Engraver's.*

"A Builder" *is informed that he is at liberty to erect the Fire Staircase, described in No.* 51.

ERRATA.—In Number 52, page 91, the fourth question should commence "an inflexible *cylindrical* vessel." Also, "when this quill is *fitted*," should have been *filled*. Q. 13, for "*æ*" read ae. Q. 17, for "*all*" read *at*. I take this opportunity of observing, that mistakes of this kind are unavoidable in correspondence, where the author has not an opportunity of correcting his own writings; so that what appears to be a confusion of ideas, is in reality only a confusion of type. This applies particularly to "Q. E. D," whose manuscripts are something between a physician's prescription and a washerwoman's bill, but less oblique than the latter; indeed the Editor once suppressed a whole paragraph because it *leant the wrong way*. Q. E. D.

Long-looked-for come at last!—A Magazine for the Boys!!

On Saturday next, November 4, will be published, with neat Engravings, price One Penny, a new Weekly Periodical, entitled

THE MAGAZINE FOR ALL THE BOYS; HOLIDAY COMPANION; and GENERAL STORY-TELLER.—The Book, instead of its Editor, will join them in all their amusements; though grave in the School-room, it will be a most cheerful associate in the Play-ground; will join them either at Cricket, or Marbles, or Leap-frog, or what they please. It will accompany them in their Fishing Excursions; make one of their Bathing Party; or seek with them the Bird's-nest. And when the setting sun reminds them of home, it will follow them thither, and in the social circle have many a pleasant Tale to tell.

London; G. Berger, Holywell-street; D. Doudney, Holloway; and all Booksellers.

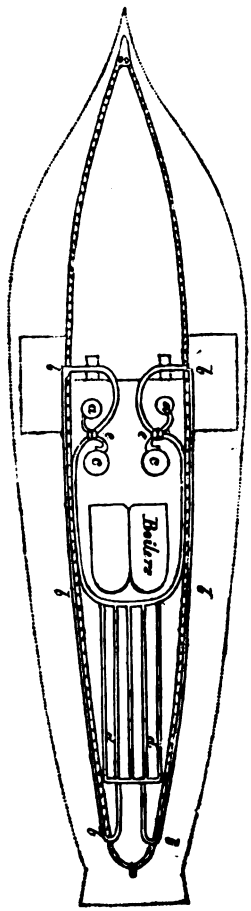
London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid): published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

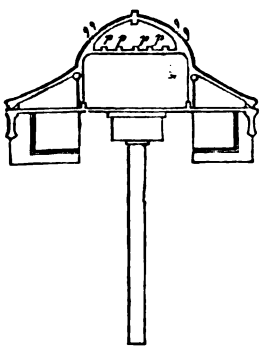
Digitized by Google

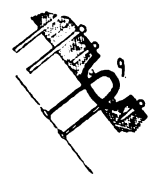
# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LIV.] SATURDAY, NOVEMBER 4, 1837. [Vol. II.

PLAN FOR WARMING STEAM-BOATS.





Vol. II.—No. LIV. Holloway Press: D. A. Doudney.

Digitized by Google

## PLAN FOR WARMING STEAM-BOATS.

*To the Editor of the* PENNY MECHANIC.

SIR,—May I request the favour of the insertion, in your Magazine, of the enclosed plan for condensing the steam in marine steam-engines, by which the heat of the steam may be partially employed in warming the cabin, or may allow it to cool at pleasure. Although simply warming the cabin is no very great object, yet the principle of condensation going on outside the vessel, I think might be turned to account, to save room, which is of great importance in marine steam-engines; and it would also answer the purpose of keeping the water clear for the use of the boiler. I am your obedient servant,

ARDENS.

EXPLANATION OF THE DRAWING.—The steam is conducted by tubes after leaving the cylinder (*c c* in the horizontal plan), to the after end of the vessel, and thence back again to the air-pumps *a a*. In part of their course the tubes are placed longitudinally along the outside of the vessel, in place of certain strokes of the planking, as at *b b* in both figures, in order that they may be exposed to the contact of the external water. In other parts of their course they pass under the cabin floors, as at *d d*. The portions of the tubes respectively nearest the cylinders and air-pumps, approach each other closely at *e e*, where they both pass through four-way cocks, by arranging which the steam may be made at will to pass round the outside of the vessel first, and be condensed before coming under the cabin floor, or else under the cabin floor before condensation, thus warming or cooling the cabin at pleasure.

ARDENS.

*To the Editor of the* PENNY MECHANIC.

SIR,—Number 51 of your Magazine contains a description of a Fire Staircase, as projected by H. Plummer; I should be sorry to deny that it is a very ingenious plan, but I fear the obstacles to its practical utility (on which I beg to make a few remarks) cannot be overcome. In the first place, with respect to the waste of ground, which in situations such as Lombard-street, where it is so valuable, I consider that not one out of fifty would make the sacrifice that must accrue in the length of a street. But even were this sacrifice submitted to, I doubt whether, in the confusion occasioned by a fire, the usual number of inmates in every house would have sufficient presence of mind to allow each other to descend safely; it is more than probable that some would be precipitated into the street. Indeed, I much fear whether any thing within the scope of human ingenuity can effect what has already been so laudably attempted in order to anticipate the distressing difficulties in question. It is rarely indeed that the instructions of those who sit down to write, in a calm state of mind, can be followed by those suffering by distressing casualties of any kind whatever. It has been justly observed, that "fire and water are good servants, but bad masters;" and all that can be said is, that it is a truly praiseworthy attempt to reduce them to the obedience of man. That presence of mind which we ought at all times to cultivate, is as equally requisite in a shipwreck as in a conflagration. The weak and timid will find difficulty in making use of the best-contrived apparatus, whilst the bold and resolute will find means of escape, influenced alone by the difficulties of the moment. I remain, Sir,

Your constant Reader, W. E. F.

[We are perfectly aware of the prejudice which is always shown in favour of old customs. This brings to our mind the story of a Dutchman, who, rather than he would divide the weight of a sack of flour on his mule's back, threw the whole on one side, with a proportionate weight of stones on the other to balance it,—because his father did so before him.—New inventions are generally considered either as innovations or impracticable. The same opposition was shown when a Legislative enactment made it imperative to erect party-walls in new buildings.]

## HOW TO EXTINGUISH FIRE.

*To the Editor of the* PENNY MECHANIC.

SIR,—Presuming you will insert any article in your Magazine that is curious and interesting, and at the same time that may become of use at some future period, I beg to ask the favour of your granting me a place in your columns, of the following method of Extinguishing Fire with a certainty of its not breaking out afresh.

As soon as the engine is in readiness to work, mix in the water that is immediately to be discharged, seven or eight pounds of pearl ashes, in powder, and continue to add it in this manner as occasion requires, taking care that it be directed against the timber or wainscot, &c., just beginning to burn. Or, when time will admit, dissolve any quantity of pearl ashes in a copper with water, and as fast as it dissolves, which will be in a

Digitized by Google

few minutes, mix a pailfull with the water in the engine pretty often; and whatever burning wood it is played upon, the fire will be extinguished, and it will not burn afresh. I remain yours, &c., Boz.

## ON THE STUDY OF MECHANICS.

NO. IV.

Sir,—In your Number 51, there is a description of a Fire Staircase, by Mr. Plummer; whatever reception it may meet with from the public, it is an excellent contrivance; and I think I am only expressing the sentiments of the majority of your readers, when I thank him for making it known. If we were accustomed to such protection, we should deem it imprudent and dangerous to be without it. A certain and easy deliverance from fire is not the only advantage obtained; it is also a protection against nocturnal depredators. Some men possess such strength of nerve and confidence in their own power and courage, that no imaginary, or even probable, danger, occasions them the least uneasiness; but nervous and timid people, whose preservation may be equally important to society, and unquestionably an object of their own especial solicitude, would not, I should think, regret the trouble or expense of a structure which would ensure them a safe retreat from fire, thieves, and murderers. There is, however, one inconvenience attending this plan, which I merely mention, in order that Mr. Plummer may apply a remedy. If every inmate of a house has at all times access to this Staircase, they might be tempted to make an illicit use of it; boys would get out upon nightly frolics; the maid would avail herself of the accommodation to enjoy the edification of some intelligent lover; and many other uncocker-like practices would be alarmingly facilitated. Even if it were to terminate in a subterraneous place of temporary refuge it would be a dangerous place of concealment. That this defect may be remedied I have not the least doubt; and I call the attention of Mr. Plummer to the subject, because I am convinced it cannot be in better hands. I think it would be less objectionable if entirely closed in the front: and I should like it to be more than 18 inches wide, otherwise a lady or gentleman 20 inches thick would stick fast and prevent others from descending. But I am, perhaps, only anticipating alterations which the inventor's own reflection will suggest to him.

Allow me, Sir, to avail myself of this occasion, to explain my views regarding descriptive communications in general: I divide them into three distinct classes, each possessing its peculiar merit.

1st. Descriptions of things and processes which are only partially known, or which require the aid of science in their explanation.

2nd. Improved methods of obtaining a required result; or methods which render the result more perfect or efficient.

3rd. Original inventions. Great scope should be allowed to this section; for however imperfect, crude, or extravagant an idea may at first appear, it should, if really original, be entertained and investigated; for though it should be evidently incapable of effecting the object proposed, it may form the nucleus of other inventions; therefore the utmost facility should be afforded to the publication of the emanations of genius, however vague and incomplete they may be.

There is an incomprehensible light in the creative mind, which is independent of all external circumstances, and which no artificial process or cultivation can create; however neglected and uninformed, it still brings forth its blossoms; but if science ripen not the fruit, they will wither in the bud, and fall abortive and unheeded. Let me then exhort all those who have conceived projects which they have not an opportunity of carrying into effect, to bring them forward, and add to the stock of public knowledge, by making them public. The date of the publication will furnish them with an incontestable proof of the priority of their invention, should others attempt, unfairly, to appropriate it: and let them be assured that this work will fall into the hands of many who are fully capable of appreciating their productions, whatever they may be.

Although I wish to see every encouragement given to the publication of inventions, I think indulgence may be carried to too great a length. Many inventors, particularly incipient ones, feel a pride, which is far from blameable, when they are able, by means of publication, to communicate their discoveries to 20 or 30,000 persons: I have no doubt we are indebted to this sentiment for much information which would otherwise have been lost in the oblivion of the "old gentleman with a scythe." This sentiment would, I think, be promoted by the exclusion of projects which are wholly useless. There is, for instance, in Number 50, an account of an air-pump, made of a pair of bellows: whether this be intended

Digitized by Google

as a mystification, or written by a person unacquainted with the subject, I cannot determine; but if the writer had informed us that he could make a fiddle with the tongues and poker it would have been equally practicable and interesting. I am aware that it is difficult to draw a line between useful and useless things; and I admit that it is better to incline towards indulgence, than hazard the discouragement of those who seek to acquire or propagate knowledge: I only wish to suggest that it would be advantageous to readers, as well as to the writers themselves, if such communications as the one I have just mentioned, were not published. Trusting that the unreserved sincerity of my observations may not be misconstrued or condemned, I remain, Sir,

Your obedient servant,

Q. E. D.

[We are decidedly of opinion that the Fire Staircase is an excellent invention, and are much pleased to find that our highly-talented correspondent, "Q. E. D." has expressed his opinion so favourably of it. Had it been brought forward by an individual with the F. R. S., and about a dozen other titles attached to his name, the plan would, no doubt, have been acted upon immediately.]

## HEAT.

NO. I.

It may be justly said of that particular branch of science which will be treated of in these papers (heat) that it is of primary importance to all mankind, considering how greatly it appertains to the very existence of all organized bodies. Bacon speaks of it in these words: "It is certain that of all the powers in nature, heat is the chief, both in the frame of nature and in the works of art." And in the present day, Dr. Lardner, in his Treatise on Heat, says, "Heat is every where present." Every body that exists contains it in quantity without known limits. The most inert and rude masses are pregnant with it. Whatever we see, hear, smell, taste, or feel, is full of it: to its influence is due that endless variety of forms which spread over and beautify the surface of the globe. Land, water, air, could not for a single instant exist as they do in its absence; all would suddenly fall into one rude formless mass, solid and impenetrable. The air of heaven, hardening into a crust, would envelop the globe, and crush within an everlasting tomb all that it contains. Heat is the parent and nurse of the endless beauties of organization; the mineral, the vegetable, and animal kingdom are its offspring. Every natural structure is either immediately produced by its agency, maintained by its influence, or intimately dependant on it. Withdraw heat, and instantly all life, motion, form, and beauty, will cease to exist; and it may be literally said, "Chaos has come again."

I propose to divide the present subject into three papers: 1st, the general effects of heat; 2nd, conduction, radiation, &c.; 3rd, the sources of heat.

In taking a review of the general effects of heat, the least contemplative mind cannot fail to notice that solids, liquids, and æriform bodies, are all alike subjected to its influence; and it will be my chief object in the present papers to introduce to the student such experiments as shall combine amusement with instruction, and tend to impress these facts firmly on his memory.

I shall begin with solids. Procure a cylindrical piece of brass, about 4 inches long, and from two to three inches in circumference; into the side of which screw a stout wire, about a foot long, to which a wooden handle can be adapted; and having accurately noted the length and breadth by two apertures in a flat piece of brass, place the cylinder in the fire, and when red hot it will be found too large to fit into the apertures which before respectively measured its length and breadth, thus proving, in the most satisfactory manner, the expansion of solids by the application of heat, and their contraction on cooling; for on the cylinder becoming cold it will fit into the apertures, as at the commencement of the experiment. The expansion of solids being minute the cylinder must be made to fit accurately into the apertures in the flat piece.

Of the expansion of liquids by heat we have many familiar examples; for instance, advantage is taken of this property of liquids for the construction of an instrument whereby we are enabled to ascertain the temperature of the surrounding air, or any other body we wish. I refer to the thermometer. The expansion and contraction of the liquid in the glass tube (it matters not whether it is spirit or quicksilver, both being equally liquids), must be so familiar to every one, that I do not deem it necessary to say more on the effects of heat on liquids, but shall proceed to notice more fully its effects on æriform bodies, which can be rendered much more conspicuous by experiment than either liquids or solids.

Digitized by Google

The expansion of air may be shown by holding a bladder, containing only a small portion of air, with the mouth firmly tied, before the fire for a few moments; the air contained therein will expand, and it will soon appear to be fully inflated; but on removing it into a colder part of the room, it will resume its ordinary appearance. Another way of showing the same, which is often resorted to, is to take a small glass tube, which terminates in a bulb; plunge the open end into a glass of water; apply the heat of a candle to the bulb, and the air contained therein will escape from the open end in small bubbles, through the water: on removing the candle, the air contained in the bulb will resume its ordinary dimensions, and the water will gradually rise in the tube, so as to nearly fill it.

What are termed gridiron pendulums are constructed on the important principle of counteracting the effects of the variations of temperature which is continually going on in the surrounding atmosphere. It being well known that as the distance from the point by which the pendulum is suspended, to that part of it called the centre of oscillation, varies, the clock will vary; in the gridiron pendulum the bars of metal are so placed, that while some increase in length downward, the others increase upward, so as to cause the centre of oscillation always to remain stationary.

SCIOLISTERUS.

## NOVEL METHOD OF RAISING SUNKEN VESSELS.

We learn, from a Gravesend paper, that Mr. Kemp is endeavouring to raise the Apollo, steamer, and the William, of Sunderland, both sunk near Gravesend. The following was the plan adopted:—A large schooner was brought to the spot, containing 32 cylindrical vessels, each 6 feet high, by 4½ in diameter, lined throughout with zinc, and having only one head. Across the open end is a strong iron, which is firmly attached to the machine, with a hook in the centre. After the situation of the vessel had been discovered by the divers (who made use of Dean's diving apparatus), they proceeded to pass a chain cable entirely round the vessel from head to stern. To this, at distances of 6 feet, is attached short bridle chains; and to the end of each of these a rope with a buoy attached to it, which floats on the surface. When every thing below is complete, the rope is passed through the eye at the open end of the cone. The cone is then cast overboard and immediately fills with water, and descends exactly to the bridle chain. The diver then goes down and secures the two together. As soon as a sufficient number are attached, a tube, connected with the air-pump, is placed under the open end, and the air is then forced from the pump into the cone; and as soon as it leaves the tube, rises naturally inside the vessel and displaces the water by taking its place at the upper end. The cylinders are filled in this manner by degrees, taking the alternate sides of head and stern first. Water being a non-elastic fluid, will naturally cause a body that may be sunk to rise to the surface as soon as it shall be made lighter by the elastic fluid contained in the cylinders. The vessel lying in mid-channel is being continually run over by other vessels, and the chain round the vessel has several times been carried away by the anchors of colliers and others getting foul of it. The buoys attached to the bridle chains have also been over and over again destroyed by the paddle-wheels of the steamers. It is, however, the opinion of most persons that Mr. K. will eventually succeed.

## IMPORTANT INVENTION OF A NEW PADDLE-WHEEL FOR STEAM-BOATS.

Dr. Christopher C. Rice, of this city, Dr. Anthony Hermage, Professor of Chemistry and Natural Philosophy, at Mount St. Mars's College, Emmetsburgh, and Professor J. Gillmeyer, of Baltimore, are associated as proprietors of a newly-invented paddle-wheel for steam-boats. As the paddle of the wheel now in use, when at work, strikes the water at an angle of 36 or 37 degrees, the water, of course, offering its resisting force to the nearly-horizontal paddle, a great degree of steam power must necessarily be applied to the main crank, so as to overcome the resistance of the opposing element. Thus, from the shock made by the two conflicting powers, the boat sustains a shock or jar, and causes the plunge of the steamer at each stroke of the paddle, which is not only as unpleasant to the passenger as it is injurious to the vessel, but it retards the progress of the steamer also. The new patent paddle strikes the water perpendicularly, thus doing away with the cause of the convulsive plunge of the boat. It works at almost any depth under water, thus proving itself fit for the ocean equally as for the river boat. It rises also perpendicularly, and thus causes no "back water;" and on this account shows itself applicable to canals, as it is to oceans or rivers. All this is effected

Digitized by Google

by the manner in which the paddles work —viz. on the cranks and pivots, and an eccentric revolution of its wheel. All the extra power requisite to be applied to the present paddle in use, for breaking at first, and lifting afterwards, the water, is saved in this instance; and which, at a moderate calculation, must be equal to one-third of fuel, and propel the boat one-third faster. Some of the most scientific men in the country, who have seen this beautiful piece of machinery, have highly praised it. We recommend it to the serious consideration of those who at this time are engaged in steam-boat navigation.—*American Paper.*

[Our illustrious countryman, Symington, invented the steam-boat; Fulton, the American, took drawings and plans of it; and then went to his own country and palmed it off as his own invention. We have little doubt but the present American *discovery*, ushered forth to the world with such a string of pompous names attached to it, is somewhat similar. The above account was transmitted to us (accompanied with a letter) by "A. Hewitt," the inventor of the Upright Paddle-wheel described in Number 50 of our Magazine. He states, that he made his model five years ago, and exhibited it to any one who asked permission to see it. He afterwards lent it to a person named M'Caulay, a corn miller, who had two sons, the eldest of whom was considered a very ingenious young man. A short time after this they both went to America; and the writer says, he believes they are the persons who have made his invention known.]

## ORIGIN OF THE DERBY SILK-MILL.

A CORRESPONDENT who writes to us, complaining of the injury done to the silk trade by the introduction of machinery, is not aware that Italy formerly supplied this country with that article, in consequence of the machinery it possessed. The following is the history of the establishment of the silk mill in this country:—

The Italians had been long in the exclusive possession of the art of silk-throwing, when, about the year 1715, a young mechanic and draftsman, named John Lombe, resolved on the perilous task of travelling into Italy, to procure drawings or models of the machines used there. He remained some time in Italy, and procured admission to the silk-works by corrupting two of the workmen, through whose assistance he inspected the machinery in private, and whatever parts he obtained a knowledge of, during these visits, he recorded on paper before he slept. When he had just completed his plan his intention was discovered, and his life being in extreme hazard he was compelled to take refuge on ship-board. Two Italians, who had favoured his scheme, and whose lives were in equal danger, accompanied him, and they all soon landed with safety in England. Fixing on Derby as a proper place for his purpose, he agreed with the corporation for an island, or swamp in the river, 500 feet long, and 52 feet wide, at 8l. yearly. Here he established his silk-mill. In the year 1718 he procured a patent to secure the profits thus arising from his address and ingenuity, for the term of 14 years; but his days verged to a close, and before half this period had elapsed, treachery and poison had brought him to the grave. The Italians, whose trade rapidly decreased, from the success of the new establishment, were exasperated to vengeance, and vowed the destruction of the man whose ingenuity had thus turned the current of their business into another channel. Through the machinations of an artful woman, sent from Italy for the purpose, they were but too successful. John Lombe was succeeded by his brother William, whose melancholy disposition led him to commit suicide; on which the property descended to his cousin, Sir T. Lombe. Previous to the expiration of the patent, Sir Thomas petitioned Parliament for a renewal of it; but the Government, willing to reward the promoters of national benefit, and at the same time to spread the knowledge of such a useful invention, granted him 14,000l. in lieu of a new patent, on condition that he should suffer a complete model of the works to be taken. This was accordingly executed, and afterwards deposited in the Tower for public inspection, and it is from this circumstance that Sir Thomas Lombe is generally, but erroneously, reputed to have introduced the silk-mill into England.

The extensive fabric occupied by the machinery stands upon huge piles of oak, doubly planked, and covered with stone-work, on which are turned 13 stone arches that sustain the walls. Its whole length is 110 feet; its breadth 39 feet; and its height 56 feet. It consists of 5 stories, besides the under works, and is lighted by 408 windows. The whole of this elaborate machine, which contains 14,000 wheels, is put in motion by a single water-wheel, 23 feet in diameter.

The above is a description of the building in its original state.

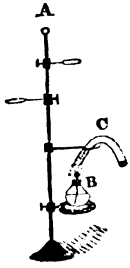
Digitized by Google

# THE CHEMIST.

## CURIOUS CHEMICAL EXPERIMENT.

HAVING procured a piece of thin glass tube, about 9 inches long and ¼ of an inch in diameter, hermetrically seal it at one end, and then bend it in the shape of the accompanying figure, which may very easily be done by holding it in the flame of a common candle or lamp till it becomes softened, and then pressing it gently with the hand till it assumes the required form; then take about half a dram of tartrate of lead (which may be procured at any chemist's shop), and having introduced it into the lower end of the tube, gradually heat it over a spirit or oil lamp till the tartrate of lead becomes quite blackened. As soon as this is the case remove it from the lamp and stop the open end of the tube with a cork. When the tube and its contents have become cold, if the cork be removed, and a little of the black powder shaken out on a plate, it will immediately take fire, and become like a little mass of red-hot charcoal.

N.B. The tube must be corked up again immediately the powder has been shaken out; and if care be taken to fasten it up tight, the powder remaining in the tube will retain the quality of igniting when exposed to the air, for several days and even weeks.




EXPLANATION OF THE FIGURE.—A, retort stand, holding the tube and its contents; B, the spirit-lamp, heating the tube; C, the glass tube and its contents.

J. G.

*Fleet-street.*

## CHEMICAL TESTS, OR RE-AGENTS.

*Liquid Ammonia* is an excellent test for copper, with which it strikes a fine blue colour.

*Solution of Soap in Alcohol* is employed to ascertain the comparative hardness of water. With distilled water it may be mixed without any change ensuing; but if added to a hard water, it produces a milkiness more considerable as the water is less pure. This effect is owing to the alkali quitting the oil whenever there is present in water any substance for which the alkali has a stronger affinity than it has for oil. Thus all uncombined acids, and all salts, except those of alkalies, decompose soap, and occasion that property in water which is termed hardness.

*Carbonic Acid* (applied either in the gaseous or liquid state) occasions a white precipitate in lime, soluble with effervescence in muriatic acid.

*Nitrate of Mercury* (in solution) is the most sensible test of ammonia; one part of which, with 30,000 parts of water, is indicated by a slight blackish-yellow tinge on adding the test.

*Metallic Tin and Nitro Muriate of Tin* (in solution) throws down gold in form of a purple oxide. On the same principle nitro-muriate of gold serves as a test for tin.

*Liquid Sulphuretted Hydrogen* is a test for both lead and arsenic; with the former it gives a black, and with the latter a yellow precipitate.

---

The following experiments are intended to give an idea of the great power and usefulness of these tests:—

*A beautiful Green Liquid produced by mixing a Blue one with a Colourless one.*—Nearly fill a test-glass with water, and add to it a spoonful of the tincture of cabbage; the mixture will be of a fine blue colour. Add next a few drops of colourless liquid ammonia; the mixture will instantly become green.—Rationale: this experiment is designed to exhibit one of the distinguishing properties of alkalies; namely, that of changing vegetable colours. A solution of potash or soda produces the same effect as liquid ammonia; but if the liquid made green by ammonia, be boiled, it regains its blue colour; because that alkali being volatile, is driven off in the gaseous state by the heat.

The following experiment shows the mode of using the common test for alkalies:—

Into a test-glass of water pour a few drops of an alkaline solution, and then dip into the mixture a slip of turmeric paper; the pale yellow colour of the test-paper will be changed to a deep brown.

Digitized by Google

*Southwark Astronomical Society*, Nelson-street, Long-lane.—On Friday, Nov. 10, Mr. Maugham will deliver a lecture on the General Properties of Matter. Admission by Tickets, which may be had gratis.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—I should feel much obliged if any of your readers would inform me how to construct a Spring Movement which would take about eight hours to run down, and which would strike off an alarum during its action. And also how those Spring Thief Alarums are constructed, which, on being disturbed, strike a bell similar to that of a Dutch clock.

H. MARSHALL.

Given two sides of a triangle (equal 34 and 24 feet), whereof the greater is parallel to the horizon. It is required to determine the length of the third side, so that the descent of a heavy body along the same may take the least time possible?

BOZ.

SIR,—I remember being told some time ago that it was possible to raise a pot of mustard and cress in a few minutes after the seed was set, by means of electricity or galvanism. If any of your Correspondents can inform me whether such is the case, and if so, how to perform the experiment, they would greatly oblige

A YOUNG MECHANIC.

SIR,—Your Correspondent, "Syret," who presented your readers with a plan for a Watch Alarum, would much increase the value of his communication by describing more minutely the manner in which the weight J is hung from the sliding piece F, and how it is disengaged therefrom, so as to fall on the lever K. In doing this at his earliest opportunity he will much oblige,

J. J.

SIR,—I wish, as an experiment, to make a wheel revolve by electro-magnetism, such as I have seen in the Lowther Arcade; but not knowing how to do so, I should be obliged if any of the readers of your miscellany could favour me with full directions, with the probable cost of the necessary apparatus.

Yours, &c. QUESTOR.

SIR,—Having tried many experiments to dry India Rubber when melted without success, I shall feel greatly obliged if any of your numerous Correspondents will inform me of the best method.

Yours, &c. BOZ.

SIR,—I should feel much obliged if any of your Correspondents could inform me of the best and cheapest method of preparing Permanent Blue and Red Writing Inks, which will not fade in their colours. And also the cheapest and best mode of preparing the Nitrous Oxide, or Laughing Gas.

*Bristol.* Yours, &c. A SUBSCRIBER.

Number 46 contains a description of the method of preparing Laughing Gas.

## ANSWERS TO QUERIES.

"A. B." Number 48, asks for a description of Mr. Hall's Steam Engine. That gentleman says, "The leading features of my invention consist, firstly, in effecting the condensation of the steam from the working cylinder, without injecting water (which in most cases contains impurities), into the condenser, by which means I am enabled to employ the same water constantly over and over again, to furnish steam; and the boilers being once charged with pure water it will always continue to be in that state, however long it may be used. Secondly, in securing the steam that usually blows away at the safety-valve, and returning the distilled water resulting therefrom to the boilers, and producing, by very simple means, the needful portion of distilled water to supply the waste that may take place in working the engines: and thirdly, in the oil for lubricating the pistons and valves being used over and over again, instead of its being washed away as in injection engines."

SIR,—I should advise your Correspondent, "W. H. P." to remove the flesh from the legs and wings of the birds he intends to stuff, if they are large; if small he will not be able. As to the shape of the wires for their support I cannot give any general rule.

Mr. Watts feels most happy in being able to oblige "A Lady," and hopes she will find the following receipt succeed:—*Court Plaister.*—Black silk is strained, and brushed over with a solution of isinglass an ounce, in proof spirit twelve ounces, to which is added two ounces of tincture of benzoin; when dry, this is to be repeated five times more; after which two coats are given of a solution of Venice turpentine, four ounces, in tincture of benzoin six ounces, which renders it less liable to crack: but some finish it with a simple tincture of black balsam of Peru.

*Water-colour Cakes.*—The colours are to be ground with gum-water, to which a little isinglass has been added; it is then to be put in a greased mould, and dried with a slow heat.

In answer to your Correspondent, "Sancho," I beg to state, that the receipts I gave for making Matches for Instantaneous Light are those in general use, if the ingredients are properly mixed I have never found them rub off. I am quite aware that a portion of the turpentine into which the wood is dipped evaporates, but the portion which is left behind, renders the wood extremely inflammable. I should advise him to give them both a fair trial, and I am sure he will find mine preferable, as they do not leave so disagreeable a smell as the sulphurised ones, and light quite as well. And I would ask him how it is the sulphurised ones sell for a shilling a thousand less than the others.

J. R. WAITS.

## TO CORRESPONDENTS.

A. W. Collins. *By inserting his Letter we should frustrate the object he has in view; viz. that of putting an end to party quarrels.*

T. M. Vaughan's *Safe-Guard for Steam-Carriages shall be inserted the earliest opportunity.*

*We are obliged to* Mr. Watts *for the papers he has sent us.*

*The Electrical Experiments sent us by* Wigo *will, no doubt, be acceptable to our readers, for which we return him thanks.*

Sciolisteros *will see that we have made use of the first of his papers on Heat. We thank him for his communication.*

A Friend to Improvement. *We think it will be impossible to guide Balloons until some powerful machinery, similar to the wings of birds, can be brought into action to propel them. A ship, when sailing, has two elements acting on it, while a balloon has but one; consequently it must go with the current.*

Mr. Burbridge's *communication on Thunder Clouds shall have a place in our Magazine.*

Long-looked-for come at last!—A Magazine for the Boys!!

Just published, with neat Engravings, price One Penny, a new Weekly Periodical, entitled,

THE MAGAZINE FOR ALL THE BOYS; HOLIDAY COMPANION; and GENERAL STORY-TELLER.—The Book, instead of its Editor, will join them in all their amusements; though grave in the School-room, it will be a most cheerful associate in the Play-ground: will join them either at Cricket, or Marbles, or Leap-frog, or what they please. It will accompany them in their Fishing Excursions; make one of their Bathing Party: or seek with them the Bird's-nest. And when the setting sun reminds them of home, it will follow them thither, and in the social circle have many a pleasant Tale to tell.

London: G. Berger, Holywell-street; D. Doudney, Holloway; and all Booksellers.

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LV.] SATURDAY, NOVEMBER 11, 1837. [Vol. II.


### PARACHUTES.

FIG. I.

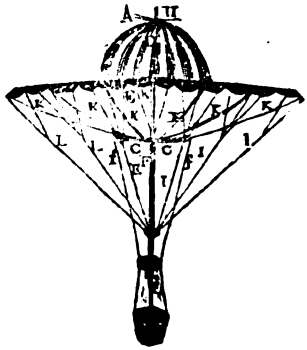



FIG. II.

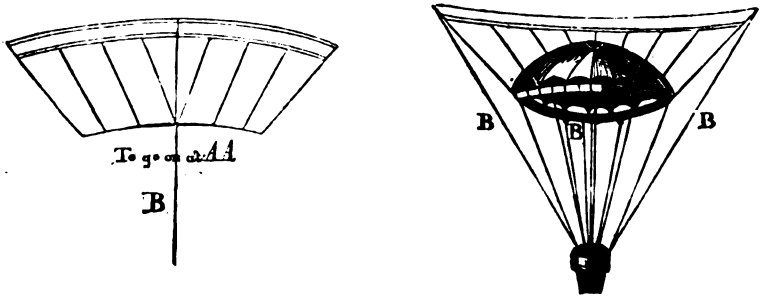
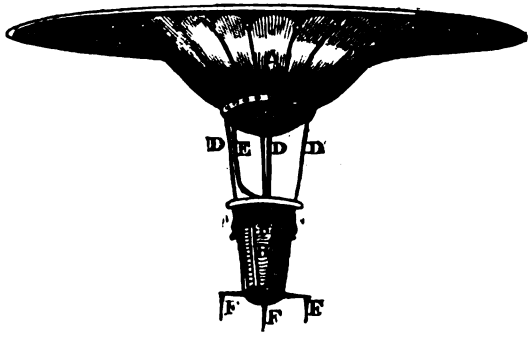



FIG. III.





Vol. II.—No. I.V.

Holloway Press: D. A. Doudney.



Digitized by Google

## PARACHUTES.

(FIG. I.)

*To the Editor of the Penny Mechanic.*

SIR,—Having constructed a parachute on a different plan to any I have yet seen, and of which I have sent you a drawing, I have made calculations and experiments, and they have always answered my fullest expectations. If you think it worthy of your notice, an insertion will oblige

Your obedient servant,

J. BURNE.

EXPLANATION OF DRAWING.—Fig. 1, the parachute descending. A the valve, to prevent the oscillation; B the valve-line; C a ash-hoop; D the cone; E the inverted cone; F a tube, reaching from the æranaut to the valve, through which passes the rope H, by which the parachute is attached to the balloon; I is an iron pin, by which the æranaut is to relieve himself, and thus avoid all inconvenience from ropes falling on his head; J four ropes, by which the basket is hung to the hoop; K twelve ribs fixed to the hoop; L twelve ropes, reaching from the tube to the end of each side, with branch ropes to prevent its collapsing.

Fig. 2, the parachute ascending. M is a stop-joint, by which the ribs are fixed to the hoop. Yours, &c.

J. BURNE.

(FIG. II.)

*To the Editor of the* PENNY MECHANIC.

SIR,—You will see by the drawing that my parachute is nothing more than Mr. Cocking's, and the orifice at the bottom filled up by one after Garnerin's principle. So certain am I of its safety, that I intend putting it to the test next summer. The parachute is prevented from oscillating by Mr. Cocking's Machine, and from coming down too fast by Garnerin's.

I have given a separate diagram of Cocking's, thinking it may show the construction better.

B B B ropes to prevent its collapsing; B to fix on at A A A.

I remain your obedient servant,

SAVILLE.

(FIG. III.)

*To the Editor of the* PENNY MECHANIC.

SIR,—Although the unfortunate descent of the late Mr. Cocking, which terminated the existence of that gentleman, is in the highest degree lamentable, yet it has been the cause of rousing the inventive spirit of all those who interest themselves in the science of ærostation, to invent a new parachute, or to improve that of Mr. Cocking; and I feel convinced that parachutes will soon be brought to such a state of perfection, that they will be the instruments for saving many a life, instead of being the cause of the death of more of our fellow creatures. Encouraged by an article in No. 31 of your Magazine, which says, "that a great many useful things are lost because persons are afraid of making their thoughts public, for fear of being ridiculed," I beg, if you think this worthy of occupyiny a place in your interesting Magazine, to honour it with an insertion.

Yours, &c. A. B.

DESCRIPTION.—A the parachute; B the car, high enough to reach up to the neck of the aeranaut; C an opening, containing a bag filled with common air, and from which an Indian rubber pipe, E, leads down into the car; the pipe has a mouth-piece and a stop-cock, so that when the æranaut makes his descent, by putting the pipe in his mouth, and opening the cock, he will be supplied with air; D D D are four steel rods, which form the communication between the parachute and the car; F F are spikes fixed to the bottom of the car, so that when the parachute reaches the ground they will fix it and keep it from upsetting.

*To the Editor of the Penny Mechanic.*

SIR,—Since the accident to the late Mr. Cocking, the minds of many seem to have been turned towards a safety parachute. The object of all, as far as I am able to judge, appears to be to prevent a further sacrifice of human life; but in producing any new contrivance of this nature, we have to fear that we do not bring another victim into the field; and it is necessary to say, that whatever may come before the public in future of this kind, let no man step into it until it has been well tried with a weight equal to his own.

Garnerin's parachute, with all its defects, is the safest, and consequently the best that has yet been tried. With a view to remove the objections to it I have endeavoured (and I think not in vain) to unite the cone with the umbrella form, without adding materially to its weight, and also to ensure its opening immediately after it is set at liberty.

The models I have made are both simply the covers of the steeple-top parasol, with the top inverted, to form the cone in the centre; and a cord from it, a little

Digitized by Google

shorter than those at the extremity. In this form the parachute falls very steadily. I have repeatedly tried this model, by twisting the cords about it rather tightly, and throwing it thirty or forty feet high; it generally uncoils itself, expands, and falls gently and steadily to the ground, with about two ounces and a half attached to it.

As an additional security, I have placed a small cane hoop in one of them, which is intended to keep it partly open in ascending, and a convenience also to unite it to the balloon. And in the event of an experiment being made with this parachute, I would recommend that the balloon should be descending sufficiently to expand the parachute, previous to its being cut away, thereby procuring the most steady departure for the earth.

I remain Yours, respectfully,

L.

[A fuller description of this parachute will be given (with an engraving) when we shall again recur to the subject of aerostation.]

## ON THE STUDY OF MECHANICS.

NO. IV.

(*Continued from page* 98.)

[Some few of our copies were printed off last week, by mistake, with the head "Mechanics, No. 4," placed over a letter, signed "Q. E. D."

DEF. 6.—*Particles.*—By a particle of matter must be understood, a quantity so small that its size becomes imperceptible; so that the effects of its inertia and gravity may be calculated without considering its size; that is, it may be assumed as a mathematical point. When we speak of the number of particles contained in a body, it is always to be understood relatively; comparison being made with another body. No separation or alteration in the arrangement of the parts of a body produces any alteration in its aggregate inertia and gravity; therefore, for the convenience of expressing quantity by numbers, a body may be considered as made up of minute parts, each possessing the same inertia and gravity, without consideration of their individual density; hence the quantity of matter contained in one body is to the quantity of matter contained in another; as the number of particles contained in one is to the number of equivalent particles contained in the other. The quantity of matter contained in a *given body* may be estimated by its aggregate inertia, or aggregate gravity.

It is the opinion of some authors, that matter is composed of indivisible and immutable particles, called *atoms*; but as experiment gives no indication of their existence, and no rational argument is adduced in support of that hypothesis, we cannot even admit the *probability* of its truth. In a future paper it will be *demonstrated* that they do not exist.

DEF. 7.—*Density* is the quantity of matter which a body contains in a *given bulk*; it is said to be *uniform* when equal quantities of matter are always contained in equal bulks; and *unequal* when equal quantities of matter are *not* contained in every equal bulk.

DEF. 8.—*Motion* is the act of a body's changing its place. The velocity with which it moves is measured by the space uniformly described in a given time; when the velocity is *not uniform*, the velocity at a given point is measured by the space which would be described in a given time, if that velocity were continued uniform. Motion is of two kinds; absolute and relative. A body is in absolute motion when it changes its place, compared with a fixed point; all bodies on the surface of the earth partake of the earth's motion, and are consequently in absolute motion: indeed, every particle of matter within the scope of our observation, appears to be in a state of considerable absolute motion; but it is more convenient to consider bodies as in absolute motion, or absolute rest, according to their motion or quiescence, when compared with the *earth* as a fixed object. (It will be seen hereafter that the absolute motion of a system does not affect the relative motions of its parts.) A body is *relatively* in motion when it changes its position compared with another body *in motion*. When two bodies move in opposite directions, their relative velocity is the *sum* of their respective absolute velocities; if they move in the same direction, it is the *difference* of their absolute velocities; and if their absolute velocities are equal and in the same direction, they are relatively at rest. In all cases, the relative velocity of two bodies is the velocity with which they approach or recede from each other; and it is therefore equal in each body, whether both, or only one, be in absolute motion.

DEF. 9.—*Momentum* is the force with which a *given body*, moving with a *given velocity*, endeavours to proceed in the direction of its motion; it may be thus distinguished from *inertia*. Inertia is an intinguished from *inertia*. Inertia is an inherent property of matter, invariable in

Digitized by Google

all places and in all circumstances; *momentum* depends upon the *quantity of motion*, that is, the quantity of matter in motion, and the velocity with which it moves; it is therefore measured by the velocity and quantity of matter jointly, as $V \times Q = M$.

DEF. 10.—*Compressibility* is that property by which a body cedes, or contracts its size, when acted upon by adequate pressure.

DEF. 11.—*Imperceptibility* is the capability which every particle of matter possesses of *altering its figure* when acted upon by an adequate force, without consideration of its absolute *compression*.

DEF. 12.—*Elasticity* is the tendency of a body to recover its former figure after being compressed, or impressed. A perfectly elastic body would recover its figure with a force equal to that employed in producing the compression, supposing the matter which is moved by compression to possess no inertia. *Specific elasticity* is the force with which a body of given dimension and figure endeavours to preserve or recover its original figure; thus the specific gravity of steel is greater than the specific elasticity of whalebone, &c.; and the specific gravity of all metals varies in different temperatures, decreasing as they approach to fusion. I observed, in a former paper, that erroneous definitions occasion considerable error in the calculations founded thereon, when they are adopted as axioms. The following example shows the impropriety of tolerating false definitions. Perfect elasticity is thus defined in the Cambridge Mechanics:—"*By a perfect elastic body we mean one which recovers its figure with a force equal to that which was employed in compressing it*," omitting the requisite qualification, "*supposing the matter moved by compression to possess no inertia.* This false definition is afterwards taken as an axiom, and produces this manifestly absurd result: "*In steel balls, the force of elasticity is to the compressing force as 5 to 9; in glass as 15 to 16; though in all cases the force of elasticity* seems *to depend, in some measure, upon the diameter of the ball.*" As far as experiment can penetrate, both glass and steel are perfectly elastic; that is, the force of elasticity is to the compressing force as 1 to 1. But it must be understood that the quantity of compression is to be limited according to their respective capabilities, and the force must be immediately removed when the compression is effected; otherwise a permanent impression may be produced. The cause of the error being so much greater in the steel ball than it is in the glass, is that the inertia of steel, compared with its specific elasticity, is proportionally greater. This question not only involves a philosophical truth, but materially affects the theory of mechanics in its practical application. I will, therefore explain it more explicitly by means of the following

PROPOSITION.

*If any force be made to act upon a perfectly-elastic body, so as to produce an impression, it will recover its former figure with a force equal to the impressing force, minus the inertia of the parts moved by the impression.*

Let F be the impressing force, E the elastic force, and X the inertia of the parts moved. Part of F will be expended upon X, and the remainder upon E; or the whole effect upon E will be $F - X$; but the force transferred from F to X will, at the end of the impression, be absorbed by E; therefore the whole effective force upon E will be $F - X + X = F = E$; and in the reaction of E its force will be partly expended upon X, and the remainder will be effective upon F; so that $E - X = F - X$ will be the momentum communicated to F when the body has recovered its former figure. The remaining force X will act in the contrary direction to E, and cause it to protrude until it has absorbed the whole momentum of X: the protruded matter will then return and produce another impression; and if not acted upon by external resistance, a continual series of vibrations will be produced: this is the cause of the vibration of all sonorous bodies.

It will be proper to observe, that in the foregoing proposition F, E, and X are supposed to act in the same, or opposite direction; to describe the effects in bodies of various figures, where the elastic force *seems* to vary, would exceed the limits of an incidental remark; but it will be explained upon some future occasion.

Q. E. D.

## HEAT.

NO. II.

(*Continued from page* 108.)

ALL heated bodies, when exposed to the air lose portions of their heat by projection, in right lines, into space, from all parts of their surfaces: this we denominate radiation. The term radiant heat, or heat flying off like light, in rays, originated with Scheet. It is so familiar to every one, that I think I need not adduce any experiment to illustrate it. Our com-

Digitized by Google

mon fire-places furnish an admirable illustration of this property of heated matter; nearly all the heat which we derive from the burning coals is furnished by radiation. Different substances, as we might naturally conclude, project or radiate heat in different quantities; and the nature of their surfaces also greatly influences their powers of radiation. Mr. Leslie made a valuable series of experiments to ascertain the radiating power of different bodies, and the following table exhibits the conclusions which that distinguished philosopher arrived at, with respect to the radiating power of different substances in atmospheric air:—

| | |
|---|---|
| Lampblack ..... | 100 |
| Writing-paper ..... | 98 |
| Crown glass..... | 90 |
| Ice ..... | 85 |
| Isinglass ..... | 75 |
| Tarnished lead ..... | 45 |
| Clean lead ..... | 19 |
| Tin plate ..... | 12 |

From the above table, it appears that any thing which tarnishes the surface of metal increases its radiating power; thus we find that tarnished lead is a much better radiator than clean lead.

Vessels intended to contain a liquid at a higher temperature than the surrounding air, and to keep that liquid as long as possible at the higher temperature, should be constructed of the worst radiators of heat; thus, a bright metal tea-pot is best adapted for the purpose, whereas a black porcelain tea-pot is the worst conceivable material for that vessel.

A certain quality is possessed by all bodies, by which heat passes through their dimensions; this property is called conduction; and, as in the case of radiation, they arrange themselves under the heads of good and bad conductors, thus is the transmission of heat effected less speedily in some than in others. Procure a solid cylindrical piece of iron, of about an inch in diameter, and one of wood, of the same size, and having wrapped a piece of paper round each in close contact with their surfaces, hold them over a candle; the paper affixed to the wood will soon be burnt through, but that in contact with the metal will be hardly affected by the heat. The cause of this is, that the metal being a good conductor, continued to absorb the heat as fast as it was imparted to the paper, and so preserved it from being burnt; whereas the wood, being a bad conductor, suffered the heat to accumulate in the paper affixed to it, and thereby caused its destruction.

All kinds of earthy matter are bad conductors of heat. It is said that the red hot balls used at Gibraltar in repelling the attacks of the Spaniards, were conveyed in wooden wheelbarrows from the furnaces to the bastions, having only a layer of sand between them.

A very pleasing experiment may be made by the student, to show the bad conducting power of water downwards; procure a glass tube, about 14 or 15 inches long, and about half an inch in diameter, fill it about three parts full with water; by holding it in an inclined position, and applying the flame of a candle about its middle, the water may be boiled in the upper part of the tube, while that situated in the lower part will be quite cold.

SCIOLISTERUS.

*To the Editor of the* PENNY MECHANIC.

SIR,—In consequence of one of your Correspondents having sent you a description of a Self-acting machine, which you have promised to insert in your useful Magazine, I beg leave to state, that I have one, which I planned some time ago. My object in sending this letter is to prevent any dispute arising, if his plan should happen to be the same as mine. It is intended for a clock, to be kept in motion as long as it will wear or last, by a moving power, purely mechanical, consisting of two lever wheels, to move of their own accord, by means of weights at the end of each lever, and the levers sliding in and out the wheels, keeps the clock in motion.

I remain your humble servant,

S. W.

## ECLIPSES.

*To the Editor of the* PENNY MECHANIC.

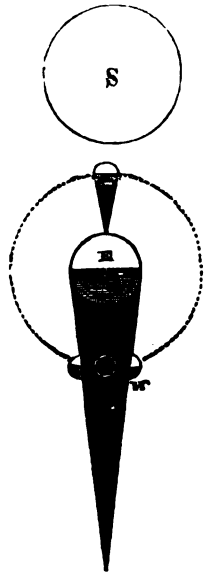
SIR,—The greater number of your readers are doubtless acquainted with the nature of an eclipse; but to many who have not an opportunity of studying such matters, a brief explanation of that phenomenon may be interesting, attention being naturally attracted to the subject by the total eclipse of the moon which we had an opportunity of observing on the night of the 13th ult.

The exact laws of the motions upon which the calculations of an eclipse are founded cannot be described without entering deeply into astronomy; but a general idea may be formed without consideration of these minutiæ or their causes.

Besides the *apparent* diurnal motion of the moon from east to west, caused by the rotation of the earth about its axis, it has a *real* motion, by which it performs a com-

Digitized by Google

plete revolution round the earth every month; this motion occasions both the solar and lunar eclipses.




Let S be the sun, E the earth, M m the moon, shown in two opposite places in its orbit. When the moon is at the point M, it is in a right line between the sun and the earth; but being smaller than the earth, and much smaller than the sun, its shadow darkens only a small part of the earth; the eclipse is consequently invisible except in the places where the shadow falls. If the *centre* of the shadow fall upon the earth, there is a *total* eclipse of the sun to a spectator placed at that point; when the shadow does not reach so far as the earth, the eclipse is anular, exhibiting a ring of light, when the centre of the moon is in a right line from the spectator, to the centre of the sun. If only *a part* of the moon intervene, the eclipse is partial. The variations which occur in the apparent diameters of the sun and moon is owing to their distances from the earth varying at different periods. The sun being on the opposite side of the moon from the spectator, it cannot illuminate any of that part which is visible to us; therefore a solar eclipse can only occur when the moon is at the change.

At m the moon is represented at the opposite side of its orbit, in three different positions of a total eclipse of the *moon*. The dark disc in the centre is the moon totally eclipsed, being so situated, that the earth intervenes and intercepts the light of the sun. Here the *earth* being the larger of the two bodies, its shadow obscures the whole disc of the moon when the centre of the moon passes through the centre of the earth's shadow. When the centre of the moon does *not* pass through or near the centre of the shadow, the eclipse is partial. When the moon is eclipsed, it is seen *alike* from all parts of the earth where it is above the horizon. Since the sun and earth are on the same side of the moon, its visible disc must be entirely illuminated immediately before and after the eclipse; that is, when the is eclipsed it must be at the full.

Although the earth totally intercepts the *direct* rays of the sun, a small portion of light is thrown on the obscured surface of the moon, by the refraction of the earth's atmosphere, which causes the rays to deviate from a right line in the same manner as is observed in the prism, or an object immersed in water, and viewed obliquely through the surface. In a very clear atmosphere the moon appears red during the eclipse; it resembles the colour of the sun seen through a thick London fog;—a phenomenon more frequent than agreeable in this part of the world. If a spectator could be placed in the moon, the aspect of an eclipse would be widely different; when we see the sun eclipsed, he would see the small circular shadow of the moon pass over the broad disc of the earth, which would appear as a *moon* to him, but three or four times larger in diameter. In a total and central eclipse of the moon, he would see the dark orb of the earth pass before the sun, presenting the appearance of a large black disc, surrounded with a deep red halo of refracted light; while the heavens, from the horizon to the zenith, would be blazing with myriads of stars, darting their unsullied light through the cloudless regions of space—a magnificent and glorious spectacle, but one which imagination only can contemplate.

Accept, Mr. Editor, the assurance of my respectful consideration towards yourself and *all* readers,

Q. E. D.

The most powerful locomotive engine yet made has just been completed by Mr. Stephenson. Its propelling wheels are seven feet in diameter, and it is capable of dragging fifty tons. It is intended to run on the Great Western Railway.

Digitized by Google

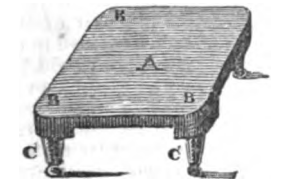
# THE CHEMIST.

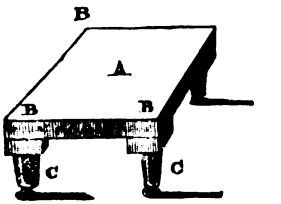
## ELECTRICAL STOOL.

*To the Editor of the* PENNY MECHANIC.

*Sir*,—I have lately discovered a very cheap method of making the Stool generally used in experiments with the electrical machine. It is as follows :—

Take a piece of deal, about eighteen inches long, fourteen inches broad, and one inch thick; let it be planed very smooth on both sides, and have the edges and corners rounded. To the under side at each corner glue a piece of the same sort of wood, four inches square, and one inch thick. When the glue is quite dry, let there be a hole bored through the centre of each of the square pieces, and wide enough to admit the bottom of the neck of a common quart bottle. Then take four quart bottles, and having knocked or cut off the necks of the shoulders, let the bottom of each neck be firmly cemented into each of the four holes. A cement well adapted for this purpose is described in No. 9 of your valuable Magazine, but which would be much improved by the addition of one part more bees-wax, and two parts of powdered red-ochre.




The subjoined figures represent the stool complete. A the top of the stool; B B B three of the square pieces of wood *glued* on to the corners (the fourth being invisible in the drawing); C C C three of the necks of the bottles.

With this stool many very interesting experiments may be performed, of which the following are a few :—

1st. Let a person stand on the stool, and with *one* hand take hold of the conductor of the electrical machine, while in action; sparks may now be drawn from any part of his body as easily as from the conductor itself.

2nd. While he still remains on the stool, let some person approach him with a warm spoon, containing a few drops of ether. If he now bring one of the knuckles of his *other* hand within a quarter of an inch of the ether, a brilliant spark will issue from it, and will ignite the ether.

3rd. Perhaps the most amusing experiment that can be performed by the aid of the electrical stool, is called the "electrical kiss." It is as foHows:—Let any lady challenge a gentleman, not acquainted with the experiment, that he will not be able to kiss her, although she may incline to meet him. If he accept the challenge let her mount the stool, and while they are inclining their heads to kiss each other, turn the machinery briskly. Provided their clothes do not touch before their lips meet, a spark of fire will fly from the lady to the gentleman, which will be sure to make him draw back, without accomplishing his design.

N.B. In all experiments with the electrical stool, care must be taken that the clothes of the person standing on the stool do not touch the table, or any other surrounding object, which would convey the electricity back to the ground as fast as it was excited in the machine.

Your's truly,

*Fleet-street.* J. G.

## CHEMICAL TESTS, OR RE-AGENTS.

***To produce a beautiful Crimson Liquid by mixing a Blue one and a Colourless one.***—To a mixture of a tea-spoonful of tincture of cabbage, with a glassful of water, add a few drops of sulphuric or muriatic acid; upon which the blue colour given by the tincture will be changed to a red.—This is designed to show the influence of acids in changing vegetable colours. If a red colour is produced by dropping a little tincture of cabbage into a certain solution, we know that that solution contains an acid; and if the reddened solution, upon being heated, becomes blue, we learn that the acid is either carbonic acid or sulphuretted hydrogen, as only those two acids are volatile.

*Test for Muriatic Acid.*—Add a drop of muriatic acid to a quart of water; pour some of the mixture into a test-glass, and let fall into it a single drop of nitrate of silver; the whole will instantly be pervaded by a milkyness, as the muriatic acid combines with the silver and form

Digitized by Google

muriate of silver, a salt highly insoluble. So great is the power of this test, that if a single grain of common salt is dissolved in 42,250 grains of water, the muriatic acid, though amounting to only 1,108,333 parts of the weight of the solution, is detected.

*Southwark Astronomical Society*, Nelson-street, Long-lane.—On Friday, Nov. 17, at eight o'clock precisely, Mr. Maugham will deliver a lecture on Heat.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—Can any of your very ingenious readers inform me of the most modern construction of the interior of a percussion gun? Also, of the inside of a Parker's patent fountain lamp?

EUGENIUS.

Sir,—Can any of your Correspondents inform me what are the colours used for painting objects on magic lanthorn slides, where I can purchase them at the cheapest rate, and the most simple method of drawing the objects fit to illustrate astronomy, natural history, &c.?

Also, the best and simplest method of constructing a Phantasmagoria? J. M. H.

## ANSWERS TO QUERIES.

"Experimenter." No. 49 of our Magazine contains an article on amusing experiments with the air pump.——He can purchase a camera obscura for half-a-crown, which he had better do than attempt at making one.

Sir,—If your Correspondent, "Pivott," should find the following preparation of any service to him, my aim in sending it will be fully answered.

Several years ago, Monsieur Chevreul discovered that all fat is composed of two distinct substances, one of which, called *elain*, remains fluid at the ordinary temperature of the atmosphere; and the other, denominated *stearine*, easily becomes solid. The former should be used for all instruments of a delicate nature to which oil is applied to prevent friction. It is obtained thus:—Oil, or fat, is exposed to the action of eight times its weight of alcohol, nearly boiling; the liquid is then poured off, and on cooling, the stearine separates in a crystalline form. The alcohol is then evaporated to a fifth part of the volume of the whole, and the elain remains, which is colourless, insipid, without smell, and difficult to congeal.

Or by squeezing tallow between the folds of porous paper, the elain is separated, and soaks into the paper, while the stearine remains behind. The paper being soaked in water, and pressed, gives up the elain.

I remain yours, EUGENIUS.

*Moulds for Casting Leaden Figures.*—If "T. E." has models to cast from, he will find plaster of Paris best suited to his purpose. Many persons cut their moulds out on hearth-stone.

No. 52. "R. W." *Why are Conical Wheels more generally used than Cylindrical ones?*—Cylindrical wheels, as usual, as they usually are, obliquely, present many disadvantages; the carriage is more easily overturned because the points of support are brought nearer to the centre of gravity; the friction on the axle increased, by the wheel acting as a lever; and a greater force is required to draw the carriage, owing to the friction of the wheel on the ground; the greater and lesser circumferences describing the rectilinear space. I am not aware that any valid reason is assigned for the adoption of so extraordinary a construction, unless it be that the wheels, being wider apart, would be inconvenient on some particular roads. Q. E. D.

"A Young Tradesman." *How is the quality of Steel in Manufactured Goods to be ascertained?*—The quality of steel cannot be ascertained unless you make the sacrifice of an article as a sample; if a file, or any cutting instrument, try it upon the hardest substance it will cut without indenting or breaking the edge, and compare its capability with a similar instrument of known quality. Other things may be examined, by observing the fracture, when broken, but this requires experience. The degree of hardness may of course be found by filing; but the surest method of knowing the quality of hardware is (with reverence be it spoken) the same which must be employed to find out the true quality of *soft-ware*) namely, by trial. Q. E. D.

[Some physicians, from long practice and very keen perception, can read a patient's disorder in the countenance. So it is with some persons who deal largely in cutlery; they can judge of the quality from the colour of the steel. The common cast-iron cutlery, for instance, has a reddish-brown tinge, while fine steel has been polished so high as to answer the purpose of a mirror.]

"E. F. D." Marble is polished with a white powder called putty (I believe it is an oxide of tin.)

## TO CORRESPONDENTS.

*If* J. J. *will send his address to* W. Syrett, *No.* 27, *Great Titchfield-street, Oxford-street, he will receive the information he requires respecting the Watch Alarum.*

*The communication from* T. M. Vaughan, Bristol, *is favourably received.*

J. G.'s *paper on the Steam Gun shall be inserted next week if possible.*

Sciolisteros. *The drawing of the Oxy-hydrogen Microscope is sent to our engraver.*

*The letter on Strikes, sent by* J. F. S., *must stand over for the present.*

J. Franklin's *Safety-valve is a very clever contrivance, and his description of it shall be inserted when the engraving is executed——We have had several models of apparatus for Sweeping Chimneys sent us. We intend inserting a description of one next week, which, we think, will entirely supersede climbing boys.*

W. J., Brighton, *shall be inserted.*

*Received* T. Matthews—J. M.—W. S., &c.

## ERRATA.

In page 108, 13th line on Heat, the apostrophes ought to have been ticketed, the quotation extends to the end of the paragraph.

In No. 53, page 98, col. 1, line 3, for "of the" read *and*; line 33, for "in action" read *extension*.

In No. 50, page 80, col. 1, line 31, for "pound" read *hour*.

Long-looked-for come at last!—A Magazine for the Boys!!

Just published, with neat Engravings, price One Penny, a new Weekly Periodical, entitled,

THE MAGAZINE FOR ALL THE BOYS; HOLIDAY COMPANION; and GENERAL STORY-TELLER.—The Book, instead of its Editor, will join them in all their amusements; though grave in the School-room, it will be a most cheerful associate in the Play-ground: will join them either at Cricket, or Marbles, or Leap-frog, or what they please. It will accompany them in their Fishing Excursions; make one of their Bathing Party; or seek with them the Bird's-nest. And when the setting sun reminds them of home, it will follow them thither, and in the social circle have many a pleasant Tale to tell.

London: G. Berger, Holywell-street; D. Doudney, Holloway; and all Booksellers.

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LVI.] SATURDAY, NOVEMBER 18, 1837. [Vol. II.


### GOTHIC AND ELLIPTIC ARCHES.

FIG. I.

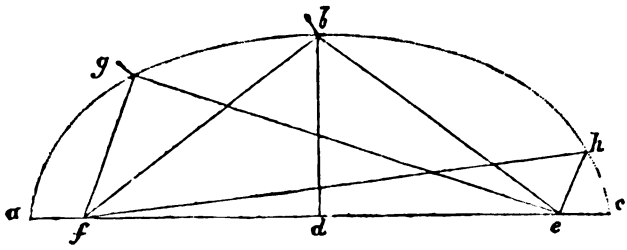



FIG. II.

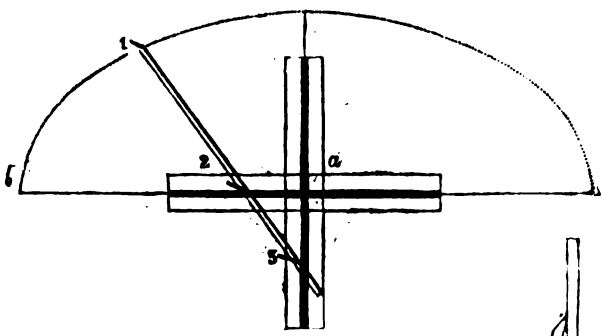
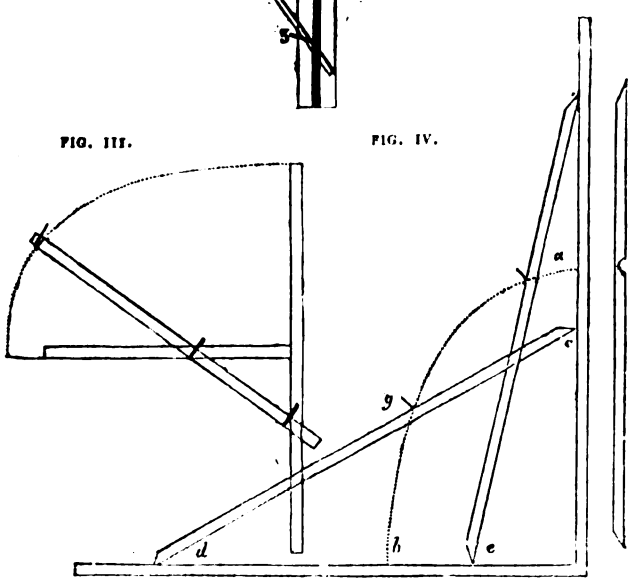



FIG. III.

FIG. IV.







Holloway Press: D. A. Doudney.



Digitized by Google

## GOTHIC AND ELLIPTIC ARCHES.

*To the Editor of the Penny Mechanic.*

SIR,—I have been waiting week after week in expectation that some one of your readers more capable than myself would notice "A.M's." method of striking the Gothic and Eliptic Arches which appeared in No. 32 of the *Mechanic*, knowing as I do, that his method is founded on false principles, but finding that no one has done so, I must take the part on myself of showing him, not only that he is in error in supposing that it is possible to strike curves of that description by means of 2—3, or even three thousand centres, but also of pointing out to him some old, but, nevertheless, true methods, which will be found to be much easier, and to be done in a much shorter time, which will have the advantage of being founded on true geometrical principles, his method being merely an invention to enable the draftsman to represent (for it is nothing more than a representation) the thing more easily on paper. Let any one who may doubt strike one by means of a string as represented at fig. 1, and examine it well, and he will find that the moment he leaves the spring at *a*, the curve gets flatter and flatter all the wall up to the crown, and consequently, no one part of a curve of that description can coincide with a circle, and therefore cannot be struck from centres. As it is necessary that the workmen should not be misled by 'A.M's.' method, I have sent you a drawing containing four methods of doing the same thing on true principles, knowing that you will, on the first opportunity, insert them together with these remarks.

I am, sir, yours respectfully,
W. H.

Fig. 1 is a very old method of describing the ellipsis with a string. Let *a c* be the span, and *b d* the height of the arch to the crown; find the two foci, which may be done by taking the distance from *a* to *d*, and set it from *b* to *f*, and from *b* to *e*, then will *f* and *e* be the two foci. Stick nails in each of the points *f* and *e*, fasten a string to each of them (the string being the length of the span), fix a pencil in the string, as seen at the point *g b* and *h*, keeping the string tight by moving the pencil round it will describe an elliptic arch, equal to the given span and height.

Fig. 2 is a method of striking the same by means of a tramel. The two pieces of wood nailed together, with a groove down the middle in the form of a cross, is the tramel; and 1 2 and 3 is the tramel-stick. At 3 and 2 are two pegs fixed in the stick to run in the grooves; and at 1 is a pencil, put through a hole in the stick. Make the distance from the point at 1 to the peg at 2, equal to the rise of the arch, and the peg at 3 to the point 1, equal to half the span; then, by moving the stick, so that the pegs pass along the grooves, the pencil at 1 will describe an ellipsis as before.

Fig. 3 is a method of doing the same half at the time by means of two laths nailed on a bench and the tramel-stick as before; only that the pegs are to pass along their sides instead of in grooves.

Fig. 4 is a method, I believe, entirely new. Form a right angle with two laths nailed on a bench; take a stick, having a notch in it to hold a pencil; the stick to be the length of half the span and the whole height together; the notch to be the length of the height from one end, and by moving the ends of the stick along the two laths the pencil in the notch will describe half the arch as before, which will be quite sufficient for general purposes. This method I believe to be my own, and I think more simple than any of the others.

## STEAM GUN.

THE following account of some experiments with the steam-gun, in its early stage, may be interesting to our readers:—

"This formidable weapon, destined if ultimately adopted, to change the whole system of modern warfare, has been so perfected by Mr. Perkins, that the effects of its projectible power, from a musket bore, and with a lead ball of the usual weight, may be fully judged. A trial was lately made at Mr. Perkins's manufactory in the Regents Park, before the Duke of Wellington and Staff, together with the field officers of the Engineers and Artillery from Woolwich, most competent to judge from their scientific knowledge. Some preparatory experiments having been made, about the hour of nine, A.M., Mr. Perkins commenced his discharges separately, but at short intervals, against an iron target, and at the distance of thirty-five yards, being the utmost length the court-yard of the manufactory would admit. The bullets were rendered perfectly flat with the lowest pressure employed; and, on increasing it, they were shattered to small pieces.

"Twelve one-inch deal planks framed in groove an inch apart, were then opposed to the gun at the same distance, and the ball passed through eleven of them. It was also discharged at a block of wood, against which the utmost force of gun-

Digitized by Google

powder had projected bullets, and it was found equal to all that gunpowder could do. Musket-balls were also sent through an iron plate one fourth of an inch thick, on which the utmost force of gunpowder had been tried, while that of the steam was not half so high as it was possible to carry it. The pressure used was about 900lbs. to the square inch, or 65 atmospheres, while it might be carried as high as 200 atmospheres with perfect safety. Hitherto steam has shown its equality with gunpowder in force, and at 100 times less expense. For example, it would require 250 musket discharges to project the same number of balls as the steam gun at a slow rate, say 250 discharges per minute, or 15,500 per hour, which would demand 15,000 charges of powder every hour. The steam-gun would do this with five bushels of coals. The difference of cost of 15,000 charges of powder and five bushels of coals is easily calculated. It next became needful to shew wherein this terrible weapon of destruction left all that gunpowder would do far beyond competition. To discharge single balls a hopper had been filled with them and they were dropped, one by one, into a barrel at the breech, as quick as the hand could move a small winch. This winch with its valve was now unscrewed, and the barrel communicated with the steam through an apparatus resembling the nave of a wheel into which it was screwed. A hole projecting like a single spoke, was screwed into this nave, (numerous radii of the same kind were shown in a model applied to one nave so that in one revolution, each would stand in turn perpendicularly over the gun:) close to the gun it had a valve above which were fifty-two musket-balls and a screw closing the orifice of the tube at the top. This tube being perpendicular, the bullets, on opening the valve, fell into the gun by their own gravity, and were projected one by one, at intervals barely perceptible to the senses, at the rate of 1000 per minute. The roar of the discharge resembled that of the loudest thunder, and the contents of one tube discharged in two or three seconds, afforded the most awful evidence of this "mighty fluid" that imagination can conceive. After a discharge or two of this kind, at the target against which the balls were shivered to atoms, and the ground strewed with their fragments, a plank of deal, about two feet wide, placed horizontally against a brick wall, was fired at, giving the gun a trifling lateral motion at the same time. The bullets perforated the board from end to end, regularly, at a few inches only apart from each other, and with astonishing regularity, the gun being capable of motion like the pipe of a fire-engine, in any direction. Thus, one musket-bore barrel would, in a second or two, annihilate a company of infantry opposed to it, in line, and discharge nearly three times as many balls at once, as a company of ninety men could do with muskets previously loaded:—to re-charge their pieces before such a weapon, would be impossible. What, then, could not fifty such guns effect; the astonishing precision with which the balls are projected, each, hitting within an inch of its predecessor, was exemplified by a discharge against a brick wall, 18 inches thick. One discharge literally dug out a hole nearly a foot in diameter, half through its entire thickness, and this with common lead balls only: iron ones would have gone through it. Ten steam cannon in a field of battle would be more than equal to 200 on the present system, and a vessel of only six guns would be rendered more than a match for a 74. Of 500 balls fired every minute from one of these guns, if only one out of twenty were to reach the mark, ten of such guns would destroy 150,000 men daily. The adoption of the most destructive implements possible in war, will be most friendly to humanity, by shortening its duration. Offensive war will profit much less than defensive. A fort may be made impregnable against an attacking force: and a breach (could such a thing be made under the fire of steam artillery) could not be stormed. It is impossible to foresee what changes this discovery may not effect in the history of nations.

There is a gun on this principle at the Adelaide Gallery of Practical Science, Lowther Arcade, West Strand, which is in hourly operation. This gun has the power of discharging 70 balls in four seconds, and can be re-charged in as many more, propelling them either singly or in volleys; so that it is possible for it to discharge 525 balls in a minute, or 31,500 in one hour.

J. G.

*To the Editor of the* PENNY MECHANIC.

SIR,—Nothing can be more injurious to the working man than the "strikes" which now and then occur, and therefore, they are fit subjects for discussion in the working man's *own publication*, the *Penny Mechanic*.

Strikes are generally brought about in this manner: a dispute will arise between a manufacturer and his workmen either in consequence of the former attempting to

Digitized by Google

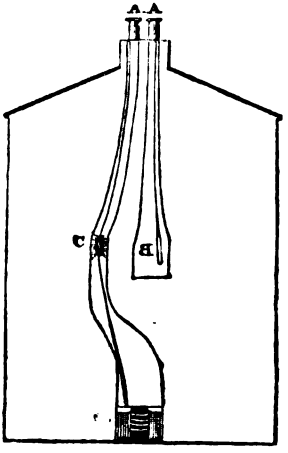
reduce the existing scale of wages, or the demanding higher prices than have hitherto been paid. A short parley will ensue, and the men, instigated by some discontented member or members of their own body, will strike, before any arrangement be made. Is this the way the business should be managed? I think not; and I have no doubt but that you will coincide with me in the opinion. The manufacturer who sees his works stopped, is, of course, much irritated, and not at all in the humour to submit to the demands of those who are the cause of it. Would it not be better for the workmen, when any dispute of the kind arises, to continue to work and endeavour to expostulate with, and explain to their employer, either the injustice of his proceedings or the justice of their own claims? I am not one to advise any man or any body of men to submit, tamely, to oppression and injustice, from whatever quarter it may come, when there is any remedy open to them; but under existing circumstances, I know of no remedy. Here we might take a lesson from the French. Why should not Trade Societies be established similar to those at present existing in some parts of France. These Societies (as stated at the last meeting of the British Association) consist of six workmen and six masters, a master to be the chairman, to whom all disputes are referred, and their decision is final.

Strikes never have done and never will do any good to the operative; but, on the contrary, are calculated to do immense harm. The man after having struck work will, perhaps, resort to the Gin-shop while the money lasts, and pass time in intoxication; when work is offered him he is loath to commence, added to the which if he have been a leader of the strike, he may have a mark placed against his name, and, out of revenge, when workmen are plentiful, be dismissed! The strike of those engaged in the building trades of London about three years ago; that of the Tailors soon after; the late strike in the Staffordshire Potteries which lasted so long and ended so disastrously; and as stated at the late meeting of the British Association, the strike of those engaged in the Building trades at Liverpool, four years ago—all these and many others may be adduced as examples of the signal failure of strikes to effect the object in view, and of their disastrous and ruinous effects on the workmen who are parties to them.

I am, sir, yours, &c.
J. F. S.

*To the Editor of the Penny Mechanic.*

SIR,—Should the following method for cleaning chimneys be worthy a place in your valuable magazine, I make no doubt it would obviate the necessity of climbing boys.




Place a small round iron bar or pulley A across the chimney top, rather to one side, over which put a small endless chain B descending to the fire-place, to which attach a whalebone brush, C, suited to the size of the chimney; by pulling up and down two or three times it will effectually bring down all the soot. When done, the brush to be detached from the chain: the small chain must remain in the chimney. Any house fitted up in this manner would require a chain to be hung in each chimney, the expense of which will be very small.

I remain sir, yours obediently,
A. M. G.

[We can see no reasonable objection to this plan; it appears to us both simple and effective: the expense of fitting it up but trifling; and wherever it may be adopted there will be no further occasion for the heart-rending cry of "Sweep" at our doors, before the dawn of day, when Winter's chilling blasts almost curdle the blood in the veins of the half-naked orphan whom fate has destined thus to be the degraded, neglected, slave of man. We wish our Correspondent every success in the adoption of his plan; and were it left to us to award the Portsmouth Prize, we should most certainly present it to A. M. G., of whom we have no knowledge, beyond what he has communicated to us in his letter.]

Digitized by Google

## HEAT.

NO. III.

(*Continued from page* 116.)

We come now to the third and concluding part of this subject, viz. the sources of heat, or the means by which it may be procured. They appear to be comprised under these terms,—the sun's rays, mechanical, chemical, and electrical action. To us the principal source of light and heat is the sun: by the presence of its rays we are warmed, and chilled by their absence. We may regard the sun and earth as two bodies of unequal temperatures, radiating heat towards each other, and the daily variation of temperature is produced by their relative position to each other. At the rising of the sun the rays strike obliquely, and consequently less of them are concentrated on any given space than when the sun is higher; the rays have also to pass through a greater extent of atmosphere when the sun is in the horizon than when he is in the zenith. There have been at different times many experiments made on the heating powers of the sun's rays, when divided with the prism; but wishing to render these papers as elementary as possible, I shall pass over these without notice, from a fear that they would be too abstruce.

The mechanical modes of exciting heat are various; such as friction, condensation, percussion, &c. Some very interesting experiments on the production of heat by friction was made by Count Rumford, in which he made water boil by the friction of a blunt steel borer in boring a brass cylinder in the same manner as cannons are bored; and we have familiar illustrations of the production of heat and fire by friction in the common Lucifer matches. Some of the savage tribes produce fire by rubbing two pieces of a particular species of wood together. Heat is evolved by compression when air is highly condensed, as in the case of the amado syringe; it is said that a faint light is perceived on the discharge of an air gun, when the air is highly condensed, this arises, no doubt, from the taking fire of some portions of combustible matter floating in the atmosphere near the mouth of the gun. The effect of percussion in producing heat is evident from the operation of the common flint and steel, as also the percussion caps used with fire-arms.

A change of temperature generally takes place when two or more bodies become chemically combined, that is, the compound so formed may have a greater or less capacity for heat than the mean of its component parts; the following are good illustrations of the heat produced by chemical action. Into a test tube pour a small quantity of water, to which add about the same quantity of sulphuric acid, considerable heat will be evolved, as may be shown by touching the outside of the tube with a wet finger, the water will be instantly evaporated. Another experiment may be made thus; mix intimately together lump sugar and some of the salt called Chlorate of Potash (both of which must be powdered fine before mixing) about as much of each as will lay on a shilling, place the mixture on a plate or piece of tin, and on letting one or two drops of sulphuric acid fall on it, it will take fire spontaneously and be consumed.

Those who have made the common experiments with the electrical machine must be familiar with those illustrating the presence of heat, firing spirits of wine, inflaming wool dipped in powdered resin, &c. But electrical action, as a source of heat, is more brilliantly shown by the voltaic arrangement, in the volatization of gold, silver, and copper leaves, these being placed so as to form part of the circuit, burn vividly, exhibiting the most brilliant colours; a battery of moderate power is, however, required to exhibit the experiment in perfection.

Thus I conclude these papers, which, (although I am aware have imperfections) I hope will be the means of stimulating the scientific student to drink deeply at the fountain of causes and effects. He sees fully the truth of the extracts in No. I. and can say with J. F. W. Herschel in his discourse on the Study of Natural Philosophy, "to the natural philosopher there is no natural object unimportant or trifling. From the least of nature's works we may learn the greatest lesson."

SCIOLISIERUS.

---

*To the Editor of the* PENNY MECHANIC.

SIR,—For some time past I have been making experiments to discover a cheaper solvent for India rubber than the one said to be used by Mr. Mackintosh, and described in his specification, and I have succeeded very well. The solvent I use is not coal oil, nor naphtha. A quart of my solvent dissolves six ounces of India rubber, which is more than double the quantity that Mr. Mackintosh says he can dissolve with a quart of purified coal oil, and at an expense not exceeding two shillings; and it becomes dry and restored to its original state by being exposed to the air for about twenty-four hours.

I shall be glad to learn from you, or any

Digitized by Google

of your readers, whether such a discovery can be turned to any profitable account, and if it can, in what manner it may be effected.

Having witnessed the following phenomenon a short time ago, I beg leave to send you a description of it. I had fastened together three pieces of half-inch deal boards, for the purpose of making an experiment of a mechanical contrivance then in hand; I had to fit in those boards several feet from the floor on which I stood; by some accident they slipped out of my hand, and descended to within about a foot of the floor, when, to my great astonishment, they ascended (in the same direction they had descended, perpendicularly to the floor) about half the distance they had fallen. I repeated the experiment several times, and the result was the same. I measured the distance accurately, and found that they had ascended some inches more than half the distance through which they had descended.

I am, Sir, Yours, &c.

F. P.

*Birmingham, Nov.* 10.

## MILTON INSTITUTION,

Founded January, 1836, for the Literary, Scientific, and Religious Improvement of the Young Men of the City of London, Milton-street, Cripplegate.

This Institution while it would afford every facility in the pursuit of Literary and Scientific information, yet, recognising the paramount interest of things unseen and eternal, desires to be instrumental in imparting that knowledge also, which maketh wise unto salvation.

It seeks to accomplish these important purposes by the use of a Library, for reference and circulation; Reading Rooms provided with select Periodicals, and Daily and Evening Papers; Lectures on various highly interesting subjects, by Professors of reputation; and Classes conducted by qualified persons.

Its means of Religious Instruction are comprised in occasional Lectures on Theological Subjects, and in a Class for the study of the Holy Scriptures conducted by a Minister of acknowledged learning and piety, to which will shortly be added, a Class for the reading of the New Testament in the original language.

The government is conducted on the popular plan by a President, Vice Presidents, and Committee chosen by the Members.

The Subscription which entitles to all the benefits of the Institution, is 1*l.* yearly, or 5*s.* quarterly, with an Entrance fee of 1*s.* Ladies are admitted to the Lectures, and the use of the Library, on payment of 10*s.* annually, or 2*s.* 6*d.* quarterly.

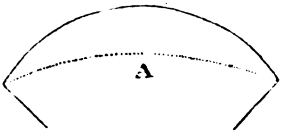
Arrangements are in progress for the removal of the Institution to a more convenient locality.

The Evening Classes, commence at Eight o'clock; subjects of studying, English Grammar, Elocution, Geography, English Composition, Arithmetic, French, Sacred Music, Drawing, Biblical Literature, and Latin.

Single Lecture Tickets, one shilling, admitting a Lady and Gentleman, or two Ladies, may be obtained of Mr. Bilton, 61, Farringdon-street; or at the Institution.

*To the Editor of the Penny Mechanic.*

Sir.—I have thought it rather surprising, that out of the many plans of parachutes contributed by various persons to scientific periodicals, none yet have devised anything for the safety of those remaining in the balloon when the parachute is detached. The tragical account of Mr. Green's at this time (given in a former number of your valuable work), seems to show that it is worthy of our attention. Under these considerations I have, for the first time, troubled you with a few of my ideas upon the subject.




I propose that the top of the parachute be made in the form of a dome; and that, instead of it being (as in most others) altogether hollow, a bottom be put to it (A), so as to make it capable of holding the coal-gas used in balloons. It will be made of such capacity as will enable it to raise, very gently, one or more individuals: a sufficient quantity of ballast being then introduced to ensure rather a rapid descent, it may be affixed to the balloon, which, as may easily be perceived, will only have the weight of the ballast to raise; consequently, when the parachute is detached, the slight weight removed will make but a small difference in the further ascent of the balloon. A valve being added to the top of the parachute, the operator can descend either rapidly or slowly, as he may deem most fit.

I am, sir, your well-wisher,

W. Burbridge.

Digitized by Google

# THE CHEMIST.

*Tests for Iron.*—Process 1. In a gobletfull of water dissolve one grain of sulphate of iron, and add a very little tincture of galls; a purple or blackish colour will be produced immediately, showing that every drop of the water is united to a portion of iron.—Process 2. To a similar diluted solution of sulphate of iron, add a drop or two of a solution of prussiate of potass, by which a beautiful Prussian blue colour will be produced.

*Test for Gold.*—To a diluted colourless solution of nitro-muriate of gold, add a few drops of a solution of any salt of tin; or stir the solution of gold with a slip of metallic tin; in either case the production of a beautiful purple or port-wine colour will be the immediate result. If the mixture is allowed to settle it becomes colourless, a purple powder (which is an oxide of gold, combines with a little tin) being precipitated. This powder is employed in the painting of china, and is called the purple precipitate of Cassius.

*Test for Copper.*—Add a few drops of a solution of nitrate of copper to a test-glass of water, the mixture will be colourless; pour into it a little liquid ammonia, the mixture will then assume a fine deep blue colour. Rationale: the alkali precipitates the copper and then dissolves it, forming a blue liquid ammoniured of copper.

*Test for Lead.*—Dissolve a grain of nitrate or acetate of lead in a glass of water, and add a little solution of sulphate of soda, a dense white precipitate (which is sulphate of lead) will be produced immediately; allow the mixture to settle, decant the clear part, and digest the precipitate in nitric acid; to the solution obtained by that means add liquid sulphuretted hydrogen, upon which a precipitate of a black colour will be produced. Thus in this experiment the lead passes through the several states of an acetate, a sulphate, a nitrate, and a hydrosulphuret.

*Test for Silver.*—Let fall a drop of a solution of nitrate of silver into a glassfull of water, and add to it a grain of common salt; mutual decomposition of the salts will take place and muriate of silver (in the form of a white powder) will be precipitated.

*Chemical Miracle! two Limpid Liquids converted by a Mixture into a Solid Mass.*—Process 1st. If a saturated solution of muriate of lime be mixed with a saturated solution of carbonate of potass (both transparent liquids), the result is the formation of an opaque and almost solid mass. Rationale: mutual decomposition of the salts takes place, muriate of potass and carbonate of lime are formed, and the latter absorbs the whole of the water of solution, and thus a degree of solidity is produced. Process 2. Drop sulphuric acid into a saturated solution of muriate of lime; in this case also an opaque mass is produced. Rationale: the muriate is decomposed and sulphate of lime (a highly soluble salt) is formed. Process 3rd. Pour a saturated solution of caustic potass into a saturated solution of sulphate of magnesia (Epsom salt) a nearly solid mass is again produced. Rationale: the sulphuric acid leaves the magnesia (which is then precipitated in the form of a white powder) in order to combine with the potass, for which it has a greater affinity.

*** If a little nitric acid be added to the product of process 1st, the solid mass will be changed into a transparent liquid, the insoluble carbonate of lime being converted into the soluble nitrate.

*To prove that every Salt has a certain determinate figure which is assumed upon crystaltization.*—Process 1st. Dissolve, in separate portions of boiling water, equal weights of sulphate of copper and nitrate of potass, pour them together while hot into an evaporating dish; drive off, by heat, a little of the water, and then suffer the mixture to cool, when the salts will shoot—the sulphate of copper into blue crystals, the nitrate of potass into white ones—precisely similar to what they were before they were dissolved. Process 2nd. Treat in the same manner sulphate of iron and muriate of soda; the former salt is separated from the solution (in green crystals) by alternate evaporation and cooling; the latter salt can only be obtained (in white crystals) by converting all the water into steam. Process 3rd. Dissolve a quarter of an ounce of each of the following salts in a small quantity of water, in separate glasses—sulphates of magnesia, iron, copper, soda, alumine, and potass—pour the whole into a Wedgewood's-ware basin, and slowly evaporate a portion of the water. When the liquid has acquired its proper degree of density (the student will be taught by practice to know when this is the case) it must be set by to cool—when every salt will crystallize in its peculiar manner, having the identical colour, form, taste, and other properties by which it was distinguished previous to its solution, the mixture of the different crystallized salts having a most pleasing, singular, and beautiful appearance.

J. R. Watts, M. D.

Digitized by Google

## LECTURES DURING THE WEEK.

*Southwark Astronomical Society*, Nelson-street, Long-lane.—On Friday, Nov. 24, at eight o'clock precisely, Mr. Maugham will deliver a lecture on Heat.

*Milton Literary and Scientific Institution*, Milton-street, Cripplegate.—On Monday, Nov. 20, at half-past eight o'clock, Professor Dewhurst, on Astronomy.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—Being desirous of making Reflecting Telescopes of the Newtonian construction, I shall feel greatly obliged if some of your numerous scientific Correspondents will be kind enough to favour me with answers to the same. Yours, &c.

*Brighton.* W. J.

What is the best composition for specula? I know that which is recommended by Mr. Edwards, but the *silver* makes it too expensive to be generally employed for specula of six or seven inches in diameter.

What is the best flux for the metal, and how should it be used?

If I wish to granulate the metal previous to casting, will the *same* flux be applicable to both purposes?

What is the most proper thickness for specula of 6½ inches diameter?

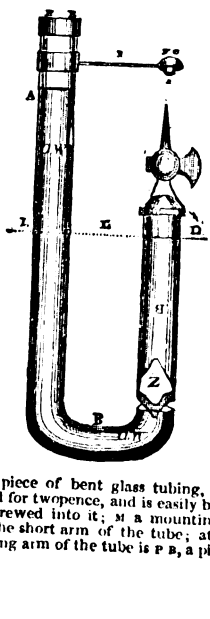
What sort of moulds are best? I have one of cast iron, but I do not like it.

What proportion, in size, should the plane metal bear to the larger one?

Presuming that it is almost impossible to cast specula of 6½ inches diameter, quite free from holes, how can the difficulty be prevented which they occasion in polishing? I have tried to polish several, but the pitch, &c., accumulating in those small holes, projects beyond the surface of the metal and spoils the figure.

## ANSWERS TO QUERIES.

Sir,—As "J. W. E." begs to be informed of the construction of the Hydrogen Instantaneous Light, I beg to submit to your attention a copy, drawn about half the size it is intended to be made, which I consider very good and cheap:—




A B C is a piece of bent glass tubing, which may be purchased for twopence, and is easily bent; S is a stop-cock, screwed into it; M a mounting piece cemented to the short arm of the tube; at the upper end of the long arm of the tube is P B, a piece of bladder, pierced with small holes to admit the air; Z is a piece of zinc, supported in the position above shown by two indentions in the glass, made by carefully heating the tube red hot, and pressing it in with any pointed substance; B C is a brass cup, which is suspended by a brass rod R, from the top of the long arm of the tube, and is used to protect the platinum ball P, from dust and injury.

To use this apparatus fill the tube to the height shown by the dotted line L L L, with a mixture of water four parts, and sulphuric acid one part (the zinc being previously placed in the position shown in the drawing) and, the stop-cock being turned off, hydrogen gas is generated, and by its elastic force, drives the mixture up the long arm of the tube in the manner shown in the engraving; consequently, when the stop-cock is turned, hydrogen issues forth from the jet J, upon the ball of spongy platinum, and causes it to be heated red-hot. When the liquor again covers the zinc, hydrogen is again generated, and drives it (*i. e.* the mixture) up the long tube as before.

CARBON.

Sir,—I beg to offer the following answer to the inquiry of your correspondent, "Boz," in No. 54.

All bodies descend an inclined plane with a velocity increasing in proportion as the plane approaches to a vertical position. The object, therefore, of your Correspondent is to bring the *required* side of his figure as near that position as the *given* side, 24 feet, will allow; to accomplish which, the angle formed by the junction of the given side and the required side must be a *right angle*. We have thus a right-angled triangle, with one side given, 14 feet, and its hypothenuse (on which it rests) 34 feet. *The square root of the difference of the squares of the given side and hypothenuse, is the length of the required side*, which in this case is 24,086, &c., viz. a small fraction more than 24 feet. This rule is applicable to finding any side similar to the above, *whatever* may be the length of the given side; but when the length of the given side, which inclines to the horizon, exceeds that of the horizontal side, the former, instead of the latter, will become the hypothenuse, and the required side will be perpendicular to the horizontal, thus forming a right angle at its junction with the same.

Or, the required side may be found sufficiently near for many practical purposes as follows:—Place the given sides together at one end: produce a line perpendicular to the other end of side 24, and bring the other end of side 34 to this perpendicular line; the point on which it falls will be the length of the side required.

By opening a common 2-feet rule, having one joint, to the distance of 17 inches between the inside points of the legs, and placing it on a table, the very triangle above described will be produced on a scale of half an inch to a foot. This position of the *2-feet rule* will in practice often answer the purpose of the *square*.

W. J.

## TO CORRESPONDENTS.

J. L.'s *letter on a new invention for preventing horses running away shall be inserted next week.*

J. G. *accepted, with thanks.*

*We beg to return thanks to the Committee, and promise to do all in our power to forward the interests of the Milton-street Institution.*

*It will be no benefit to the public merely to insert the nights of meeting at the London Electrical Society, without stating the Lectures to be delivered.*

Forguer *need not be ashamed of his invention; it shall be noticed shortly.*

J. Evans *had better send us an Engraving or a model. We cannot keep up a private correspondence.*

*Received*—Wigo—H. B. S.—D. Williams—Brack—Johannes—J. Allen.

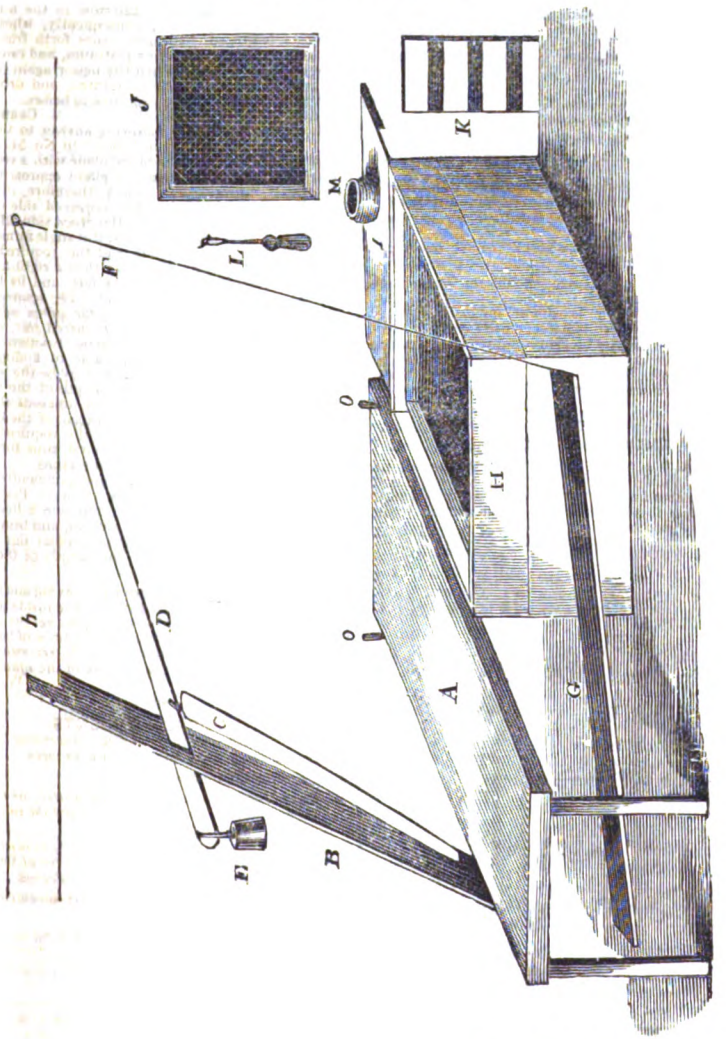
London: Printed at the Holloway Press, by D. A. Doudney; where all Communications are to be addressed (post paid); published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LVII.] SATURDAY, NOVEMBER 25, 1837. [Vol. II.


PAPER STAINING MACHINE.





Vol. II.—No. LVII. Holloway Press: D. A. Doudney.



Digitized by Google

## PAPER STAINING.

*To the Editor of the* PENNY MECHANIC.

EXPLANATION OF DIAGRAM.—A, is a table made of wood—a a, are two uprights—6, is a beam, which is placed below the ceiling of the place where the work is carried on—B, is a strong thick piece of wood, fixed to the table at one end, and to the beam at the other—D, is a lever pole—C, a dolly—E, a weight, fastened to the lever pole—G, a treddle—F, a line, which unites the lever pole and treddle together—H, is a slush box—I, a shelf—J, a sieve—K, a print or block—L, a brush—M, a pan for colour.

I think upon reference to the diagram you will perceive the simple and ingenious manner in which the machine is constructed; but in order that the process of it, and the manner in which paper is stained, should be perfectly understood by your readers, I introduce a further explanation.

The slush box H, is filled as far as the mark, (which is the bottom) with water, (leaving room for the frame, which will be next explained); in the box fits a frame made of wood, over which, a piece of leather is nailed, and made water tight. The sieve J, (which is composed of a wooden frame, covered with thick blanket) is put into the frame just mentioned, and spread over as thin as possible, with the colour to be used, by the brush L—next the print is taken by the workman, and dipped into the sieve—a piece of paper (which is twelve yards in length) is taken, and a wire is pushed through, and placed in the little groves that are made in the uprights, —when the paper is pulled by the end, it rolls off. This being done, the workman takes the print, (which has a strap on the back for his hand, to lift it by) and lays it on the paper on the table as required, pulls the dolly C out, so as to press upon the centre of the print—stands upon the treddle—which, by the communication of the cord F to the lever pole D, presses the dolly C upon the point; after pressing sufficiently, he gets off; the treddle, owing to the weight E, rises; the dolly, which has a cord and weight tied to it, and works upon a pully at the back of B, moves to position in diagram. The workman prints off the paper, dips it in the sieve again and proceeds as before. When a piece is finished, it is hung up by small, long, and square rollers to dry, (by the boy kept for the purpose,) upon poles.

There are one or two other branches of this trade, which are the bronzing, flocking, metalling, &c., an account of which I shall send you another time.

*Islington.* I remain, &c. C. PARKE.

## NEW INVENTION TO PREVENT HORSES RUNNING AWAY.

*To the Editor of the* PENNY MECHANIC.

SIR,—Aware of the facilities your Magazine affords, and the readiness and promptitude with which you insert the contributions of those who may not have the opportunities of making known to the public their inventions through any other source, I, *without* the knowledge of the person in question, beg to notice the following useful, but hitherto unnoticed, invention, of a very ingenious and clever amateur.

This person, with true philanthrophy, taking into attentive consideration the numerous accidents daily occurring of the most serious character from horses running away, but more especially in the case of stage coaches, was induced to construct a *machine* for arresting almost instantaneously the progress of the runaway cattle, without any risk of the guard or coachman dismounting, &c. The machine in question I cannot describe with that minutiæ I might otherwise do, without infringing upon the inventor's rights. It is small, and under the direct and immediate controul of the *coachman*. It consists of a cylinder of strong metal, about two feet long and four inches in diameter, containing an extremely powerful spiral spring (I believe) which can be easily and quickly wound to any extent, thereby increasing its powers. This machine is fixed on the *footboard* of the coachman's seat, and is always wound up; there is attached to it an extra pair of strong reins: when, on emergency, the coachman wants to stop the horses, he has merely to put his *toe* to a spring catch, and it *immediately throws* the *horses on their haunches*, or pulls them with such force as to check their career at once. The machine scarcely weighs 20lbs., and the cost is trifling.

Its powers may, perhaps, be doubted; but I can assure you, that when only slightly wound up, it easily overpowered four strong men.

It was exhibited before an equerry of one of the royal stables, who expressed himself perfectly satisfied as to its powers, and promised to notice it to his superiors, and assist the inventor; but he, like others, has forgotten to keep his promise.

At this trial, it threw half a dozen stablemen down momentarily, and then not at the full extent of its power.

It is so small as not to be in the least incommodious or burthensome; I believe its only fault is, that it requires an extra pair of powerful reins, but you will admit this is a very trifling fault.

Digitized by Google

Could this machine once be brought to public notice and fairly tried, I doubt not but that it would be universally adopted, as there is nothing unsightly in its appearance, but rather an improvement, and so much at the instantaneous controul of the driver as to require no other person's assistance.

I have given this hasty notice in the hopes that the inventor may meet with that support he so well merits.

I am, &c.

J. L.

## ANSWERS TO QUESTIONS IN No. 52.

*To the Editor of the* PENNY MECHANIC.

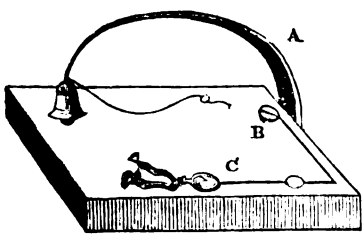
SIR,—If you think it will be interesting to your readers, I will now send answers to the twenty questions published in No. 52, p. 91. I propose sending the answer to one question taken in order, every week. No. 1 is so simple as scarcely to require an explanation: but, for the sake of regularity, I think it will be better to answer them all.

"What is the difference between *half past six o'clock in the evening* and 6h. 30m. P.M.?"

The first relates to *mean time* as known by a clock; varying at different seasons as indicated in the almanack. The latter refers to *solar time* as shown by a sun-dial, and signifies six hours and a half reckoned from the instant when the sun was on meridian. 6h. 30m. A.M. means *five hours and a half* before the sun arrives at the meridian. At the present time 6h. 30m. P.M. is about a quarter past six by the clock.

Q. E. D.

## WATCH ALARUM.




SEEING a great deal lately in your Magazine on the subject of alarums, I beg to submit to your notice a plan of one for a watch, which, for its cheapness, simplicity, and the ease of setting it to the required time, will, I think, bear competition with any.

At one corner of a flat board, about ten inches square, fix a bell by means of an arched spring, A, at the same corner drive in a nail or screw so that it shall stand up about a quarter of an inch high to form a fulcrum for a wire lever; B, the end of which is bent round as in the figure, to which the crook at the end of the string fastened to the bell, is pitched as near as possible to the fulcrum; this lever, being placed under a small croat fixed in the board to prevent its rising, is kept back by its point resting against the end of another smaller lever C, made of a thin piece of brass and fixed to the board at its fulcrum by a screw; the long end of this lever is bent up from the board just high enough for it to be close upon the face of the watch (which is placed in a hole made in the board for the purpose) and must be thin enough to allow the minute hand to pass over it without touching; but, when the hour hand comes round, it will move the lever forward, the other end moving away from the lever B, it will start forward and let go the bell, when the elasticity of the spring will cause it to ring about a minute. At whatever hour it is wished to ring, that figure must be placed under the lever.

I am, &c.

J. H. C.

*To the Editor of the* PENNY MECHANIC.

SIR,—I sometimes have an opportunity of seeing the Naval and Military Gazette, in which is inserted an advertisement that improved telescopes are manufactured at No. 52, Great Russel Street, at various prices, for various lengths and powers of vision; now, I would ask if it would not be a further improvement in the telescope if it was so constructed as to possess four or more different powers in the same telescope without the trouble of adding to, or taking from it, but merely adjusting by a graduated scale. I have a small one of the above description with four different powers, the lowest eighteen, the highest thirty-six. I have likewise a reflecting telescope of the Gregorian form, which erects the object, which needs no small eye-hole; in fact, the small eye-hole is detrimental to distinct vision; this telescope will admit of a much greater magnifying power than a Gregorian one of the same size. I am a constant reader and admirer of your little Penny Mechanic, and if you will insert this, I shall feel obliged.

I remain, &c.

FORGEUR.

Digitized by Google

P. S. I am not aware that any telescopes are manufactured of the above description, if there are, the above information is useless; the above-named articles were made by the writer for his own use, he having ground the glasses, made and turned every thing belonging but the tubes, his own business being of a very different description.

SIR,—I have invariably found a greater difficulty in polishing flint glass than I have crown; if any of your numerous friends and contributors will kindly point out the method of doing it, it will be thankfully acknowledged by me.

*October 18th.*

## PURE VEGETABLE OIL.

*To the Editor of the Penny Mechanic.*

SIR,—Pivot wishes to know how he may obtain pure vegetable oil for watches; the small bottles sold for that use purporting to contain purified oil, is unqualified quackery; it is the finest quality of olive oil in the same state in which it is imported, and may be obtained from any respectable dealer or oil refiner. Olive oil is usually submitted to a process of filtering before it is sold for use; but I have seen samples taken before and after the operation, and one appeared to me as bright as the other. Oil is filtered through bags made of a peculiar kind of cloth of very close texture, which retains any feculent matter which may be suspended in it. When a jar of oil is frozen, the congelation will not take place simultaneously throughout the whole mass, the middle part retaining its fluidity longer than that which is nearer the surface of the vessel; there is a prevalent notion amongst Horologists, that the part which is longest in freezing, is of a superior quality to the rest; this is an error; one part will freeze as soon as another under like circumstances. Bleaching is another process to which oil is sometimes submitted; various methods are employed for this purpose; the most convenient process is, when circumstances will permit, exposure to the sun's rays in transparent bottles; but as opportunities of doing this are very uncertain in this climate, chemical means are resorted to, which produce nearly the same effect. I have seen olive oil bleached by exposure to a high temperature, considerably above boiling water, and mixed with certain ingredients which act upon the colouring matter; this oil was almost white, and it was affirmed that it did not freeze at the temperature which froze the same oil previous to that operation. The olium ricini possesses the property of retaining its fluidity at a lower temperature than most other oils; but this is not the only property required for watches; when a small quantity of oil is exposed to the air a long time, it becomes thickened by the absorbtion of oxygen, and thus lessens the impulsive action, and impedes the motion of the balance; and, notwithstanding the precautions which are taken to render the long and short vibrations of equal duration, a sensible diminution in the arc of vibration cannot take place without risking some derangement in the rate of going. This inconvenience is particularly felt at sea; chronometers, often remaining several years in a ship without an opportunity of replacing the oil, and even if that could be done, the rate would probably be altered thereby. I do not admit as an established fact that vegetable oils are superior to animal oils; on the contrary I have strong reasons for preferring the latter. This is a subject which merits the most zealous investigation, and chemists have not, I think, bestowed that attention which its importance demands.

I am, &c.
Q. E. D.

## WATER.

WATER is a transparent colourless liquid which has neither taste nor smell; it is a compound of two substances which assume the form of gases when separated from each other, namely, hydrogen and oxygen. It is a powerful refracter of light, conducts heat very slowly, and is a very imperfect conductor of electricity. The celebrated Mr. Cavendish discovered the chemical composition of water about the year 1781, by burning oxygen and hydrogen gases in a dry glass vessel, when a quantity of pure water was generated exactly equal in weight to that of the gases which had disappeared. Its composition was also determined with great care by Dulong and Berrelius, they state as a mean of three very accurate experiments, that 100 parts of pure water consists of 11·1 parts of hydrogen, and 88·9 of oxygen, which is very nearly the ratio of 1 to 8. The specific gravity of water is 1, the density of all solid and liquid bodies being referred to as a term of comparison. 1 cubic inch at 62° Fahrenheit, and thirty inches of the barometer weighs 252,458 grains, so that it is 815 heavier than atmospheric air. The purest water that can

Digitized by Google

be found as a natural production is procured by melting freshly fallen snow. But this is not absolutely pure, for if it be placed under the receiver of an air pump, or boiled quickly for a few minutes, bubbles of gas will escape from it. The relations of water with respect to heat are highly important, but I shall leave this to a future opportunity to discuss.

GELOSO.

## ON THE STUDY OF MECHANICS.

NO. V.

(*Continued from page 98.*)

DEF. 13.—*Malleability* is the capability of certain bodies to receive and *retain* an impression; it is a compound property, depending partly upon the *absence of adequate elastic force*, and partly upon a *positive force* opposing the body's return to its former figure. This property enables us to produce permanent impressions upon medals, and otherwise to alter the figure of bodies by pressure.

DEF. 14.—*Hardness* is *a force* by means of which bodies resist separation, or alteration in the arrangement of their parts. All bodies are capable of altering their figure in some degree when acted upon by adequate force. Let F be the hardness or force of protrusion; and P a force acting in the opposite direction. If P = F, there will be equilibrium; and if P be greater than F, an impression will be produced by the excess of P; otherwise the lesser force would sustain the greater, which is impossible. It is also demonstrable by the laws of motion that every particle of matter is essentially impressible.

The notion of perfect hardness, is a spurious offspring of the doctrine of infinity; it is defined "*a body whose parts cannot be separated, or moved one amongst another by any infinite force.*" (Wood, art. 91). We are also informed in the same work, that "*matter is that which is divisible*;" therefore, a perfectly hard body, should have been defined "*a body composed of matter which is not matter*" whereby rendering the absurdity of the doctrine more apparent, the student would have been less liable to imbibe the error. The qualification "*cannot be separated by any finite force,*" has no meaning; all forces are essentially finite; the contrary supposition is not only incorrect, but extremely absurd.

DEF. 15.—*Weight* is the force with which *a given body* tends towards the earth. When the force of gravity is invariable, the weight is proportional to the quantity of matter contained in the body; if the force of gravity be variable, the weight is proportional to the force of gravity, and quantity of matter jointly; or $G \times Q = W$; but it is necessary to observe that this distinction applies only to weight considered as a *force*. One ounce in England signifies the same quantity of matter as one ounce at Calcutta; but at the latter place, that quantity of matter will incline downwards with less force than in England, or a greater quantity of matter must be taken to produce a force = one ounce removed farther from the equator (def. 5). The weight of a *given bulk* is called its *specific gravity*.

DEF. 16.—*Force* is whatever changes, or tends to change the state of rest or uniform rectiliniar motion of a body. There are three kinds of forces; *inertia, attraction*, and *protrusion*; every possible case of motion is the effect of one or more of these forces. *Inertia* acts only upon adjacent particles of matter in relative motion; without motion, inertia produces no effect. *Attraction* is on the contrary wholly independent of motion; it acts both upon adjacent and detached particles of matter, and if the junction of two attracting bodies be prevented by the action of a contrary force, their *tendency* to approach each other will continue, though no motion be produced. As the object of mechanics, *gravity* is the chief attractive force; but *all* attractive and repulsive forces, belong to this division. Repulsion is regulated by the same laws as attraction, and may be considered as the negative state of attraction. The *active* force of *protrusion* is *elasticity*; but the former term is adopted, because it is more comprehensive, and applies to the force with which solid bodies resist compression; which is the only case in which this force is not wholly the effect of elasticity.

Forces are usually divided into constant and impulsive; uniform and variable; and also moving, and accelerating. I neither describe nor comment upon this classification as the only advantage obtained by understanding it would be the capability of perceiving its impropriety. The classification I have established is derived from the book of nature; the only book which philosophers seem to refrain from pillaging.

I am, &c.

Q. E. D.

Digitized by Google

## ASHMOLEAN SOCIETY.

*Oxford, Nov.* 6.—Mr. Tancred, of Merton College, delivered a paper on the subject of the boracic acid collected from the Lagoons of Tuscany. After a short sketch of the progressive investigations into the nature of borax, boracic acid, and boron, since 1702, and of the chief uses of borax, he proceeded to quote the account of the method of collecting this salt in Thibet, from the Philosophical Transactions of 1787. The borax of commerce, however (the refined borate of soda), is no longer imported from those distant parts, but is obtained in the Tuscan Maremna, near Volterra. The process of collecting, &c., was then described. The geological features of the country are as follows:—The vapour seems to rise in the valleys and on the sides of the hills, composed of compact limestone with no organic remains, called Alberese, which is considered by Mr. Lyell to be a part of the greywacke formation, but is ranked by Professor Savi, of Pisa, much higher up in the geological series. The vapour has a constant tendency to corrode the strata through which it passes, and to cause land-slips, which stop up the issues of the vapour, and thus compel it to find a new exit; these exits are observed to advance gradually in their course towards the culminating points of the hills. The limestone is traversed at Monte Rotondo, by a siliceous and quartzose rock. There are in the neighbourhood several hot springs, particularly at Bagnio Morbo. Not far off are found formations of salt, sulphur, gypsum, alabaster, serpentine, and chalcedony, of which last the beautiful works in *pietra dura* at Florence are executed—Mr. Twiss remarked, that in the crater of Vulcano, one of the Lipari Islands, Passolin, or native boracic acid, is found in beautiful white feathery crystals, deposited by sublimation on the sulphur. It is found there under the same circumstances as Monte Rotondo, near Sienna.—Professor Wilson made some remarks on the locality and nature of the Indian borax or *tincal*, on the mode of collecting it, and on the employment of it as a flux for metallurgical purposes in India.

Professor Powell introduced to the Society Mr. Harper, who exhibited a magnetic needle, formed by two watch springs, separated by a piece of box wood, on the centre of which the needle played. The object was to show how hard steel might be rendered available for the purpose of magnets, being calculated to retain its power much longer than soft steel, which is generally employed. Mr. Harper likewise exhibited a simple and ingenious method of increasing the power of an electrical machine, by connecting it with the earth by means of a chain.

## ZOOLOGICAL SOCIETY.

*Nov.* 14.—Thomas Bell, Esq., F. R. S. in the chair.—Dr. Barry, of Edinburgh, exhibited a live specimen of *Proteus anguinus*, the habitat of which curious amphibia is in the limestone mountains between Trieste and Vienna. A letter was also read from Professor Wagner of Vienna, on some interesting points in the physiology of the species. Prince Lucien Buonaparte read a paper on a proposed new arrangement of fishes, founded on the position of the branchiæ. These he characterized in three classes, five subdivisions, and twelve orders. Mr. Gray made some observations on the different species of Sorex, and took occasion to insist on the propriety of paying more attention to the external characters of mammalia, which he considered to offer better modes of distinction than even by the teeth. The Prince of Musignano remarked that he had discovered fourteen species in Italy alone, and it was probable that many might have escaped observation which inhabit this country. Mr. Gould exhibited two small collections of birds, from Mr. Keith Abbott, of Trebizond, and Mr. Hearne, of Haiti. The former contained nine species, of which three, viz. one lark, and two linnets, were entirely new to science; there was also one of the common redstart of England, which has never previously been met with so far in the east. In the latter were some humming-birds, one of which, of a green colour, differed from that recently described by Mr. Gould as *Todus viridus*. He also exhibited a drawing of two specimens of Nyctidus (male and female), which he named *N. pectoralis*, remarking that, from the form of the tarsi, which were scarcely a quarter of an inch long, the account given by Azara, that the bird, when on the ground, had no power to rise again, was probably correct. Mr. Yarrell exhibited a large specimen of white bait, six inches long, remarking, that this fish, although it was considered to be confined to the Thames, was met with in many other rivers in England; the greater number met with in the former river, he ascribed to the more successful mode adopted for catching the fish.

Digitized by Google

# THE CHEMIST.

## CHEMICAL AFFINITY.

A query inserted at p. 104 has led me to make some observations on *The power that causes chemical union*; in other words, to inquire by what superior attraction does one body unite itself to another body of a compound, at the same time liberating that substance which previously formed a part of the compound; and also what enabled the bodies of the first compound to enter into union.

By most chemists this power has been termed chemical attraction, or affinity; while others wish the doctrine of affinity to be discarded, as it conveys a vague notion of the cause it is intended to explain. According to the majority of chemists, "W. Y.'s" query, No. 2, is explained as follows:—

Iron, heated to *redness* in a tube, is capable of decomposing steam when passed over it, because it is supposed to possess a greater attraction for oxygen than hydrogen has, therefore oxide of iron is formed and hydrogen is liberated. When oxide of iron is decomposed at a red heat, by hydrogen passed over it, we are told, the oxide is disunited because hydrogen has a greater affinity for oxygen than iron has. Behold, how satisfactory are these explanations! Alas, unfortunately for science, this is too frequently the case. This method of reducing oxide of iron is used by several analysts to estimate the quantity of metal in a mixture of protoxide and peroxide. At a white heat, according to some chemists, iron will not decompose steam. Nor can we assign a more rational cause to explain these phenomena. Our attempt may not be unsuccessful, as sometimes in searching for one thing we may find our search not totally unprofitable in other points of view.

It appears to me (and thanks to "W. Y." for calling my attention to this subject) electricity plays the most important part in chemical changes; because at one time it disunites bodies, at another it recombines those compounds which it has decomposed, and it can also retard, or, perhaps, prevent, combination.

Take water as a case in point. Electricity in a gradual stream will separate it into its elements; and when an electrical discharge takes place in a mixture of oxygen and hydrogen (the elements of water), they combine to reassume their former liquid state.

Several curious cases where chemical action was retarded by the introduction of platinum and brass rods into solutions, were related at the late meeting of the British Scientific Association, which, I think, can only be explained by supposing chemical combination to take place by an electro-positive element, coming in contact with one that is negatively electrified; and in the cases alluded to (an account of which can be seen in other magazines), no doubt action of the bodies present was prevented or suspended, by introducing another body in such a state of electricity, as to disorder the state of those present in the liquid.

When sulphur and copper are exposed to heat in a flask, light is evolved and combination ensues. According to Brande, at the time of union each is oppositely electrified; and no doubt the light is produced by electrical discharge. This is a beautiful experiment, and can be performed by mixing eight parts of copper filings with two parts of flowers of sulphur, then expose the mixture in a flask to a gentle heat, by a chemical lamp. It can also be performed by holding the flask over a clear fire, taking care not to apply the heat too suddenly; by this plan any sulphur that is volatilised will be carreid up the chimney.

"Sir H. Davy established the grand law of electro-dedomposition, that metals, inflammable bodies, all alies, earths, and oxides, are determined to the negative surface or pole; and oxygen, chlorine, iodine, and acids, to the positive pole.

"The intimate relation between the electrical and chemical changes, is evident likewise in the general phenomena of the voltaic battery. The most powerful voltaic combinations are formed by substances that act chemically with most energy upon each other. Such substances as undergo no chemical changes in these combinations, exhibit no electrical powers."

I think these remarks will draw the attention of some of your correspondents to the subject, and they may be serviceable in arousing scientific research.

With respect to W. Y.'s query, we must suppose steam and heated iron to be oppositely electrified. Iron as a positive electric attracts the negative body (oxygen) in the steam, hydrogen is therefore freed, and can be collected in proper apparatus. In the second case, we must suppose hydrogen to have acquired a stronger supply of positive electricity than the iron possesses, consequently, this oxide is decomposed, and watery vapour reproduced.

It appears more philosoph cal to ascribe chemical combinations and decompositions to electricity, than to say they are caused by an unknown agency termed affinity, which, like fluarine, has never been obtained in an insulated state, and tangible form. Yours, &c. X.

*Clapham Common.*

Digitized by Google

## LECTURES DURING THE WEEK.

*Southwark Astronomical Society*, Nelson-street, Long-lane.—On Friday, Dec. 1, at eight o'clock precisely, Mr. Tatum will deliver a lecture on Anatomy and Physiology of Plants.

*Milton Literary and Scientific Institution*, Milton-street, Cripplegate.—On Monday, Nov. 27, at half-past eight o'clock, Professor Dewhurst, on Astronomy.

*London Electrical Society.*—The evening meetings will be held in the theatre of the Gallery of Practical Science, Adelaide Street.—On Saturday, Dec. 2, 16; Jan. 6, 20; Feb. 3, 17; March 3, 17: April 7, 21; May 5, 19; June 2, 16; July 7, 21: Aug. 4, 18; Sept. 1, 15; at seven o'Clock.

*City of London Literary and Scientific Institution.*—On Wednesday, Nov. 29, at eight o'Clock precisely, Rev. R. Vaughan on Roman Literature.

*Southwark Literary Society*, No. 37, Bridge-house Place, Newington Causeway.—On Wednesday, Nov. 29, T. F. Goddard, Esq., on the Analogies of the Vegetable and Animal kingdoms, and the Polarization of Light.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—I should feel obliged if any of your Readers would inform me, through the medium of your valuable Publication, the simplest and best manner of polishing nautilus and other sea shells.

G. J. W.

Sir,—I should feel much obliged if any of your intelligent Readers could inform me in what way the gas is introduced into the iron bottles which the Portable Gas Company use, and also, what pressure is used to force the gas out of the burner.

Yours, COLUMBUS.

Sir,—I should feel extremely obliged to you, if you, or any of yonr numerous Readers, could inform me of the best mode of gilding letters on paper.

A. FANTASTICUS.

"C. Saville," wishes to know why the correspondent who signs himself "A. B." in the last number, prefers steel rods for attaching his parachute to the car instead of the common rope.

Sir,—I should feel obliged to any of your intelligent Readers who could inform me of a method of making a crimson light to raise a fire balloon that will answer the purpose of spirits of wine.

J. C. A.

Sir,—Would you have the goodness to inform me, through the medium of your useful Periodical, how I can make a good blue black, or French black dye for silk?

W. M., A Constant Reader.

Sir,—Can any of your numerous Readers inform me of the best work containing the Arts and Sciences alphabetically arranged.

H. KIDGER.

Sir,—May I ask your Readers, through the medium of your useful Magazine, of what the composition used for ornaments in picture frames is composed.

F——.

Sir,—Can any of your Correspondents inform me the best method of pickling German Silver, and the best way to whiten it.

R. H.

Sir,—If you, or one of your intelligent Readers, would inform me the best and most simple method of manufacturing Soap and Candles through the medium of your valuable little work, you would confer on me a favour that would not soon be forgot.

T. DENFORD.

## ANSWERS TO QUERIES.

*To make Red Ink.*—Take four ounces of the rasp-ings of Brasil wood, infuse three pints of good colourless (or distilled) vinegar, or white wine, for two or three days, boil it gently down to a quart; filter it while hot through paper; put it again over the fire, and dissolve in it, first half an ounce of gum arabic then half an ounce each of alum and white sugar.

ALEC.

"Sancho." "I beg leave to state that the receipt for Matches for Instantaneous Light, given by J. R. Watts, is incorrect:" and *I* beg leave to state that the worthy squire's mixture of shel-lac and turpentine is, according to a certain vocabulary, a "mare's nest;" for it so happens, that shell-lac is insoluble in essential oil; and further, that the readers of this work are much indebted to Mr. Watts for the many interesting articles he contributes, and above all for his kind and polite attention to the numerous queries with which he is pestered; and I regret exceedingly that *even one* should be found inconsiderate enough to comment upon that gentleman's writing in a style so ungenerous. "Look before you leap:" sapiens nihil affirmat quod non probet; and if you play at bowls you must expect rubbers.

Q. E. D.

I beg to inform your correspondent "Boz" that there is no way yet discovered of drying melted Indian Rubber.

"Questor" can get the necessary apparatus for setting his wheel in motion at a chemist's in Newgate Street, three doors from Christ's Hospital, for 7*s.* 6*d.*

T. GYLES.

## TO CORRESPONDENTS.

C. T. H—*d. should refer to No.* 38 *of the Mechanic.*

*We thank* Geleso *for his kind offer; any interesting papers he may be pleased to favour us with shall be inserted.*

*We have to apologize for not answering* Mr. Hall's *letter to us before (which had been mislaid). We now beg leave to state that our columns shall be open for the insertion of any of his useful inventions, which he may be pleased to send us a description of.*

J. A. C. *It is strange his bookseller has not sent him the Index and Frontispiece. It was published with No.* 45.

A Constant Reader *had better peruse our back Numbers, and he will find the information he requires.*

*We beg leave to inform* W. T. H., *and the rest of our Correspondents who have sent us answers to* A. Z.'s *Query, that we should have inserted one (sent us by* Q. E. D.) *before this, had not our Engraver delayed the wood cut.*

J. S. Holland's *Water Gauge for Steam boilers shall be inserted when the engraving is executed.*

Alexander M'Gillivray *shall not be forgotten, should enquiry be made at our Office.*

*We beg to inform our Correspondent,* F. Millar, *that we had received no communication from the Southwark Literary Society previous to our going to press with the present Number. The Institution shall be noticed next week.*

## ERRATA.

In No. 55, in the article on the Study of Mechanics, def. 9, last line, for "as" read *or*; def. 11, for "imperceptibility" read *impressibility*; def. 12, in several places "specific gravity" is substituted for *specific elasticity*.

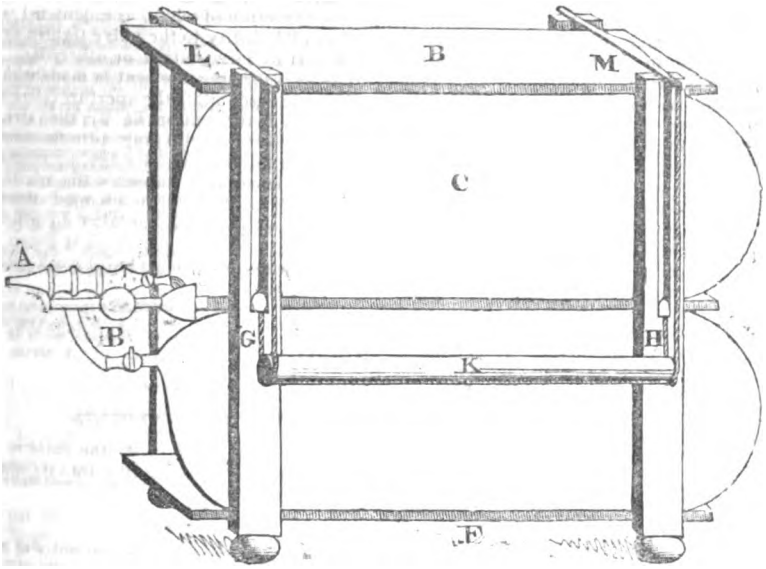
London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BENOKE, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LVIII.] SATURDAY, DECEMBER 2, 1837. [Vol. II.

### SIMPLE OXY-HYDROGEN BLOW-PIPE.




### STEAM BOILER SAFETY-VALVE.

FIG. I.

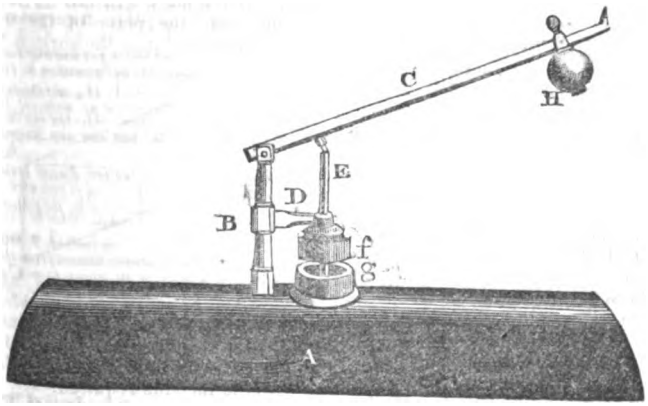
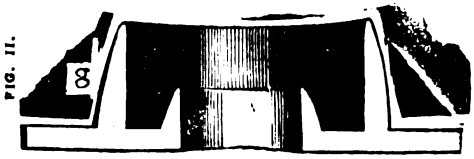



FIG. II.






Holloway Press: D. A. Doudney.

Digitized by Google

## SIMPLE OXY-HYDROGEN BLOW-PIPE.

*To the Editor of the Penny Mechanic.*

SIR,—Observing since your Magazine has been established that much information with regard to philosophical apparatus has been inserted, under the denomination of cheap, improved, or some such like term, I beg to request the favour of the insertion of the accompanying plan for an oxy-hydrogen blowpipe, which I think can lay claim to the titles of both cheap and improved, that is, in comparison to the gas blowpipes generally sold by the philosophical instrument makers, who, I believe, charge from two to three pounds for that instrument, whereas the one I am about to describe can be constructed for less than half that sum, which is a great desideratum to the scientific student, and will therefore, I hope, be acceptable to your numerous readers.

This arrangement for an oxy-hydrogen blowpipe was adopted a short time since by a friend of mine at Brighton, and having since made one myself on the same plan, and finding it exceedingly simple and compact, I conceived it ought to be more generally known. The following is an

### EXPLANATION OF THE DRAWING.

A represents Daniel's blowpipe jet, firmly held by a screw in the projecting arm B. The gases are contained in the bladders C D, which are fitted with stop cocks to regulate the supply of either gas; the bladders are confined between the moveable boards E F; to the under side of F are attached the cords G H; these, after passing over pulleys shown in the side of the frame, pass under the pulleys fixed to the ends of the leaden weight K, and are attached to the projecting extremities of the cross pieces L M; a small hook might with advantage be placed in the centre of the weight K to ease the pressure on the bladders occasionally, by hanging it on the centre board.

The action is exceedingly simple, and requires but little explanation. By the descent of the weights (of which only one can be seen in the drawing), the under board is drawn up, while at the same time the upper one is pulled down, and thus both gasses are simultaneously forced out.

SCIOLISTERUS.

## STEAM BOILER SAFETY VALVE.

*To the Editor of the Penny Mechanic.*

SIR,—Accompanying this letter is a model of a safety valve for a steam engine boiler the construction of which is calculated to remove all liability to the valve tightening in its seat by incrustation or otherwise.

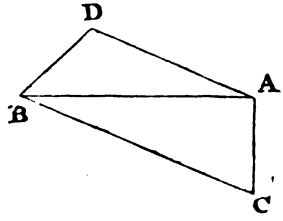
The part forming the seat is made with a channel surrounding the aperture (shown more fully in the section, fig. 2); the valve, instead of being a solid plug, is in the form of an inverted cup, whose edge, by means of the rod working through the arm D, accommodates itself to the channel of the seat, the bolt of which contains a portion of packing. Should you deem it deserving a place in your very useful work, you will oblige,

Yours, &c.
J. FRANKLIN.

### DESCRIPTION.

A, a portion of the roof of the boiler; B, a pillar carrying the fulcrum of the steelyard C; D, a short arm secured to the pillar and forming the guide to the valve rod E, and the valve descending into its seat g, H, the weight.

QUEST. in No. 54. Given two sides of a triangle whereof the greater is parallel to the horizon, to determine the third side, down which a body will fall in the least possible time, the plane of the triangle being perpendicular to the horizon.*




Draw A B = greater side, and from the point A, draw A C = lesser side, and perpendicular to A B; join C B, and draw B D = A C, making ∠ C B D, = ∠ A C B, and A D is the side required.

Q. E. D.

* I have taken the liberty of correcting an obvious defect in the original question, and have also made it more comprehensive; it is scarcely necessary to remark, that if A B be taken = 34, and B D = 24, ∠ A B D being given, (= A C B − C B A) A D may be measured by any of the methods of trigonometry.

Digitized by Google

## STUFFED ANIMALS.

M. LAURENT, a distinguished French naturalist, after ten years' experience, recommends the following composition for preserving the skins of stuffed animals. He observes at the same time, that it penetrates them with greater readiness, and preserves them much better than any preparation which has hitherto been in use.

His receipt is as follows:—

| | |
|---|---|
| Arseniate of potass | 2 drams. |
| Sulphate of alumine, (or Alum) | 2 do. |
| Powdered camphor | 2 do. |
| Powdered white soap | ½ ounce. |
| Spirits of wine | 6 do. |
| Essence of Thyme | 30 drops. |

The arseniate, alum, camphor, and soap, are to be placed in a phial with a large mouth, and the spirits of wine, heated to 89° F. is then to be poured upon them. It will be perfectly combined in 24 hours' time, when the essence of thyme is to be added, and then the phial is to be carefully corked down. This composition is to be shaken together before it is made use of, and it is to be spread over the coat of the animal with a brush. J. G.

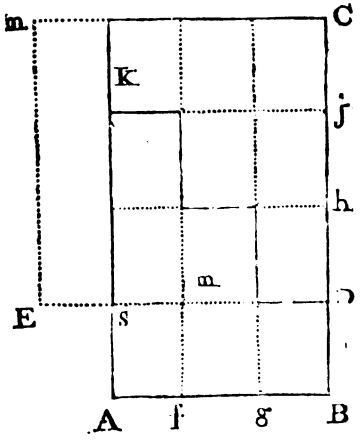
---

SIR,

"A. Z.," (in No. 53.) enquires how a parallel ogram whose sides are respectively two inches, and one inch and an eighth, can be divided into two parts which may be joined together so as to form a square; he also wishes to be informed, by what process of calculation, the answer is obtained.

No general rule is applicable to the solution of questions of this irregular nature; sound logic, and methodical reasoning, will sometimes obtain the required result, where no application of the analytical art would avail. The best general directions I can give, are these: always endeavour to establish some proportion or analogy between the thing sought, and the things given; so that you may express the thing required in known terms. If this cannot be done, endeavour to prove that it is impossible; if you cannot succeed in doing this, observe where the proof is defective, and direct your investigation to that point; and if the solution be possible, you will find it there. In all cases you must reason *methodically*, investigating every part thoroughly before you dismiss it, and then pass to another point, and be careful to avoid the practice of unskilful reasoners, who return over and over again to things upon which they have already decided, or you will lose much time unprofitably, and your labour will most probably be fruitless. We will take the above question as an example.

A little consideration will convince us that the parallelogram must be rectangled; this we will assume as a sub-auditure of the question.




The square being by the question equal to the given parallelogram, a side (S) of the square, is a mean proportional between A B, & C B; that is, A B : S :: S : C B or A B × C B = $S^2$; & A B = 9, C B = 16, (eighths) therefore $S^2 = 144$; & $\sqrt{144} = 12 = S$. & $S = \frac{3}{4}$ C B = $\frac{4}{3}$ A B; therefore take C D = $\frac{3}{4}$ C B and from D draw D E parallel to A B and equal to D C, and complete the square E *n* C D. It is evident that the whole A *s* D B must be taken away, since it projects beyond the boundaries of the square E *n* C D; and that quantity cannot be taken part from each end of C B, because there being but two pieces, the points C and B would be connected. Now since one-fourth must be taken from C B, and one-third A B added to D *s*, divide A B into three equal parts at *f* and *g*; also divide C D into three parts at *h* and *j*, each equal to B D, and from these points draw perpendiculars to the opposite side of the parallelogram; thus dividing the whole figure into parts which are respectively required to be taken from one side, and added to the other. Having done this, it is only necessary to inspect the figure, in order to discover the line of separation, which is the black line from *k* to D. Now make A B coincide with E *m*, and A *k* with E *n* and a square is formed by joining the two parts; which was to be done.

Cor. 1. If A B be divided into any

Digitized by Google

number of equal parts, and C B into the same number + 1, any parallelogram may be transformed into another of different proportions; and when C B — B D = A B + $f$ A, a square will be formed by joining the two parts as before.

Cor. 2. When a square is required; A B and C B must be square numbers, thus 16 (= $4^2$) × 9 (= $3^2$) = $12^2$, & $6^2$ × $5^2$ = $30^2$ and so on to any number of proportions; the parallelogram continually approximating to a square.

Cor. 3. By a similar process, a square may be transformed into an unlimited number of parallelograms of different proportions.

I am, Sir,
Your obedient servant,
Q. E. D.

---

Sir,

In your last Number (57) there is an article headed "Water," upon which I beg leave to offer a few remarks. The first assertion "water is colourless," is I am aware considered perfectly orthodox, and it is not my intention to assert the contrary; but there are circumstances which lead me to *conjecture* that water is not perfectly colourless. Everyone must have observed that a very large body of clear water appears to be tinged with green or blue, and though I cannot affirm that such is always the case, I have found so far as my observations have extended, that in clear water, the colour is proportional to the depth of water through which the light passes. I have had frequent opportunities of making observations on the Rhone in a part near the lake of Geneva, where the water is remarkably clear. In passing over a bridge where a number of white objects, as broken plates, oyster-shells, &c., may be seen lying at the bottom, I have invariably observed that those lying in the deepest part, appeared of a dark blue colour, and objects nearer to the shore appeared paler and paler as they approached the shallow water where no colour could be perceived. Everybody says that this is the effect of reflection and refraction; but as "everybody" is a very capricious personage, and easily led into error, I cannot take his word when appearances are so much against him. I have observed the same effect with a blue sky, and with a cloudy one; and I am convinced that it depends upon no variable cause; when the lake is agitated by the wind, the water assumes a greenish colour, and after a violent storm, it becomes thick and yellow, which shows that the blue colour is not derived from the soil at the bottom. Chemists insist that this water contains no substance in solution which could possibly impart that colour; they attribute the appearance to optical causes which it is not their business to investigate; and the optical gentlemen say that it is caused by the presence of certain colouring matter, the nature of which must be determined by chemical analysis. At a great distance from land, the sea is invariably blue; but in some places near shore, as in the straits of Sunda, the colour *appears* less intense, though the water is remarkably clear. The most decisive experiment would be to fill a *very long* tube with distilled water, and observe the appearance of a white object seen through it. When we see an object immersed in water, the light passes *twice* through the water before it reaches the eye.

"Geloso," says, "water is a powerful refracter of light;" this I must contradict, water being on the contrary remarkable as a very weak refracter of light. Take a small glass globe, such as is used for making watch-glasses, and fill it with water; if you stick a piece of thin paper on one side, and present the opposite side to the sun,* the light will be condensed into a luminous disc upon the paper, by the refraction of the water; measure the diameter of this disc, and then substitute other fluids, much rarer than water, and they will contract the light into a much smaller space. A more accurate measurement may be obtained by this means, than by measuring the distance of the focus; the diameter of the disc refracted by water is something more than forty degrees; while the disc refracted by essential oils, (much rarer liquids) is *less than thirty*. Both the absolute and relative refracting power of different liquids may thus be accurately estimated; but it must be observed, that the angle of refraction is not proportional to the diameter of the disc; it is as the diameter of the circle of incidence, minus the diameter of the refracted disc, allowance being made for the convexity of the surface upon which the refracted rays are exhibited. With respect to the proportion of the component parts of water, I invite the reader to compare what is stated by "Geloso," with "the Chemist" (No. 48.), and I recommend all those who study chemistry, to be careful not to confuse the force of protrusion and the consequent extension

* Any light diverging from a small focus may be employed, provided the same distance be preserved in each experiment.

Digitized by Google

of a body, with quantity; the only direct means we possess of estimating quantity, are inertia and gravity.

Your obedient Servant,
Q. E. D.

## THE EFFECTS OF HEAT UPON WATER.

Water is a singular exception to the general effects of heat, for it increases in bulk, or expands, in passing from the liquid to the solid state, all the methods which have been explained have been applied to this liquid, and all concur in proving, that as its temperature is lowered towards the point at which it is converted into a solid, contraction does not proceed in the same uniform manner, as the general law would lead us to conclude; for contraction entirely stops at about thirty-nine degrees of the common thermometer; but if the temperature be still further lowered an expansion is produced, and continues in an increasing ratio until the water is frozen. The most remarkable circumstance attending this expansion, is the great force with which fit is effected. The Florentine acedemicians burst a hollow brass globe whose cavity was only an inch in diameter, by freezing the water with which it was filled, and it has been estimated that the expansive power requisite to produce such an effect was equal to a pressure of 27,720 pounds weight.

Another effect of heat upon water is Vapsuration, which will be understood better under the two heads of Ebullition, and Evaporation. Water cannot be heated under common circumstances beyond 212° Fah.; and this is called the boiling point, which is always the same provided the necessary conditions are observed, but it is liable to be effected by several circumstances. The nature of the vessel has some influence upon it. Thus Gay Lussac observed that pure water boils precisely at 212° in a metallic vessel, and at 214° in one of glass, owing apparently to its adhering to glass more powerfully than to metal. All bodies upon the earth are constantly exposed to considerable pressure, for the atmosphere itself presses with a force equivalent to the weight of fifteen pounds on every square inch of surface, and this has also a great influence on the boiling point of liquids, for if the pressure be less, and the barometer below thirty degrees, the boiling point of water will be lower than usual, or if the barometer rise above thirty degrees, the temperature of ebullition will be proportionally increased. Robison found that water boils in vacuo at seventy-two degrees.

The only difference between "ebullition" and "evaporation" is, that, the one takes place quietly, the other with the appearance of boiling.

Evaporation occurs at common temperatures. This fact may be proved by exposing water in a shallow vessel to the air for a few days, when it will gradually diminish, and at last disappear entirely. Most fluids, if not all, are susceptible of this gradual dissipation, and it may also be observed in some solids, as for example in camphor. But evaporation is much more rapid in some fluids than in others, and it is always found that these fluids, the boiling point of which is lowest, evaporate with the greatest rapidity.

Geloso.

## SOUTHWARK LITERARY SOCIETY,

*No. 7, Bridge-House Place, Newington Causeway.*

The object of the Southwark Literary Society is to afford to the inhabitants of the neighbourhood, opportunities of obtaining Literary, Scientific, and General Information, and to foster a taste for the acquisition of knowledge, by making use of those means for its communication which shall create the least amount of difficulty, and afford the largest measure of mental gratification.

Lectures are delivered weekly during the greater portion of the year; it will be perceived each member is entitled personally to introduce a lady, and extra tickets of admission may be obtained on the terms specified in the Syllabus.

The advanced intelligence of the times renders it unnecessary for the Committee to dilate upon the value or importance of this department of the society's operations; it will be their leading object to select such branches of information as are likely to prove useful and acceptable to their fellow-members, and to make choice of Lecturers recommended not only by their high literary or scientific acquirements, but by the talent they have evinced for conveying instruction in a popular and agreeable form. The lectures on the various branches of science and literature to be considered during the ensuing session, will be conducted in a manner as attractive as is consistent with that sound method best fitted for imparting a clear and comprehensive view of the several subjects.

Of the success of the lecturers in combining these objects, the committee entertain the most confident anticipations.

Digitized by Google

The committee have great pleasure in announcing that the studies of the French class will be under the able superintendence of Monsieur Ragon, Tutor of the French Language at the London University, and Professor at the London Mechanics Institution.

The class for the discussion of questions of general interest formed, during the last year, one of the most attractive sections of the society, and the committee fully expect that it will at least maintain its former interest.

Besides these, classes are in the progress of formation for the study of Drawing, Music, and Mathematics, and the committee will afford every facility for the promotion of other classes, being desirous of cultivating these important auxiliaries to the increase of general instruction and amusement.

The library consists of more than 3,500 volumes for circulation and reference, including the most valuable standard works, the journals of the Houses of Lords and Commons, and the works published by the Commissioners of Public Record. Several of the works recently published, have been purchased, and the committee will endeavour to meet the wishes of the members by the addition from time to time of new works of interest.

The Reading Room is supplied with most of the Reviews, Magazines, and other popular periodicals of the day.

The principal daily papers, both morning and evening, are found in the News Room, which is open from nine o'clock in the morning till ten in the evening. The society also possess a Museum of natural and artificial curiosities and specimens of various kinds, to which several interesting additions have lately been made.

The committee have pleasure in announcing that no Admission Fee is now required from those who join the society, and considering that the district presents a scope for the working of a Literary Society equal to any other part of London, they are prepared to make every exertion to raise an institution affording advantages at least equal to those offered by similar institutions in other metropolitan districts. They beg strongly to urge upon all connected with the society, the necessity of active co-operation in promoting its interests; and when the number of the present members is taken into account, together with the attractive nature of the lectures to be delivered, there can be no doubt that, if the personal recommendation of each individual member were added to the exertions of the committee the prosperity of the society might be very much advanced, and its utility still further extended.

Terms of Subscription to the Reading and News Rooms, Library, Lectures, &c. (which entitles each Member to introduce a Lady to the Lectures, 1*l.* 10*s.* per annum. Lady's Subscription to the Library and Lectures, 1*l.*

## MISCELLANIES.

*Preservation of Vegetable Substances.*—It is well known that animal substances are preserved from putrefaction by corrosive sublimate, but that vegetable substances, however saturated they may be with this sublimate, discharge all the metallic salt when exposed to water. It is the gelatine of animal substances which combines with the mercurial salt, and thus forms an insoluble and imputrescent composition. A. M. Tellier, in order to make the sublimate useful for vegetable matter, proposes that it should be steeped in a cold concentrated solution of sublimate, then thoroughly dried; after which it should be plunged in a warm solution of one part gelatine to eight parts of water. By this means all the salt is decomposed, and if afterwards exposed to the action of water, the latter will be strongly coloured with excess of gelatine, but affords no traces of mercurial salt.

*Curious Experiment.*—Get a lighted candle and place it on a table, in the middle there is no flame in consequence of the air not getting inside to supply it; if you place one end of a tobacco pipe inside the flame, and light the other, a beautiful flame will appear.

*Simple plan to show the Expansion of Solids.*—Procure a conical tube, somewhat resembling an extinguisher, make it red hot; put a ring upon it, and mark where it comes to; then let the cone get cold; place the ring on again, and it will come down farther; make the ring hot, and it will come down still farther.

*Electric-Magnetic Engine.*—N. J. Collan, of Maynooth College, is constructing an Electro-Magnetic engine, which he says "will contain forty electro-magnets, and I expect that, with a battery containing six square feet of zinc, it will propel, at the rate of seven or eight miles an hour, a carriage which along with its load, will weigh thirteen hundred weight. The engine will be ready for work in the end of this month or in the beginning of the next."

Digitized by Google

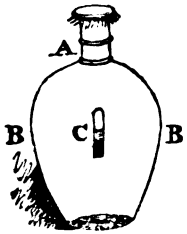
# THE CHEMIST.

## SINGULAR PNEUMATIC EXPERIMENT.

*To the Editor of the* PENNY MECHANIC.

SIR,—Take a piece of thin glass tube 3½ inches long, about ⅜ of an inch diameter, and hermetically sealed at one end. Then nearly fill it with water, taking care to leave sufficient air in it as will just serve to keep it afloat when it is immersed with the open end downwards in water.

Provide also a common wine decanter and fill it about up to the shoulder with water, and then put the tube in, taking care that none of the water escape from it, and let it float. Then take a piece of bladder, and having soaked it well, tie it quite air-tight over the orifice of the decanter. The apparatus complete is then as represented in the figure.




A. The neck of the decanter filled with air.

B. B. The body of the decanter.

C. The glass tube in the position it generally takes when the bladder is gently pressed.

O. The bladder tied over the neck of the decanter.

If now the fingers be gently pressed on the bladder, the piece of glass tube will instantly descend to the bottom of the decanter, and on their removal, it will as quickly ascend to the surface of the liquid. If the fingers are alternately applied and removed, the tube will be agitated in the middle of the fluid in such a manner as to excite the astonishment and wonder of those unacquainted with the cause.

The *rationale* of this experiment is as follows. When the fingers are pressed upon the bladder, there being no escape for the air contained in the upper part of the decanter (marked A) it becomes to a certain degree condensed. The water contained in the decanter conveys this pressure to the air contained in the tube which, in consequence of this pressure, occupies a less space. In order to fill up the vacuum thus created, the water rises in the tube. It then becomes specifically heavier than its own bulk of water, and instantly sinks.

On the removal of the finger, the pressure on water is taken away, the air contained in the tube is restored to its original bulk, and the consequence is, it ascends to the surface.

Those balloons, which we see at glass exhibitions, floating in water contained in tall glass jars covered with Indian rubber act upon the same principle as this, and if one of them be taken out of the jar and carefully examined, a little hole will be perceived in the lower part of it which allows the pressure on the surface of the water, contained in the jar to be conveyed to that in the balloon, and thus cause its descent, &c.

J. G.

*Fleet-Street, Nov.* 13.

*A Fountain of Fire, formed by phosphuretted Hydrogen Gas.*—Put fifteen grains of finely-granulated zinc, and six grains of phosphorus cut in small pieces (cut this under water) into a glass; mix in another glass a drachm by measure of sulphuric acid with two drachms of water. Now take the two glasses into a dark room, and then pour the diluted acid over the zinc and phosphorus in the other glass; in a short time phosphurated hydrogen gas will be produced, and beautiful jets of bluish flame will dart from all parts of the surface of the liquid, the mixture will be quite luminous, and a quantity of beautiful luminous smoke will rise in a column from the glass. A fountain of fire is a very apt name for the appearance that is produced. The experiment is very easily performed, and is a very beautiful one.

*Tartaric Acid.*—Take two pounds and a half of cream of tartar, three gallons of distilled water, a pound of prepared chalk, a pound of sulphuric acid, boil the cream of tartar with two gallons of the distilled water, and add gradually the prepared chalk until bubbles are no longer excited, set by (the mixture) that the tartrate of lime may subside, pour off the liquor and wash the tartarate of lime frequently with distilled water until it is free from taste, then pour upon it the sulphuric acid diluted with a gallon of boiling distilled water and set it by for twenty-four hours, frequently stirring it. Strain the liquor and evaporate it in a water bath that crystals may be formed.

Digitized by Google

# INSTITUTIONS.

### LECTURES DURING THE WEEK.

*Southwark Astronomical Society*, Nelson-street, Long-lane.—On Friday, Dec. 8, at eight o'clock precisely, Mr. Ogilvie, on Electricity.

*Southwark Literary Society*, No. 37, Bridge-house Place, Newington Causeway.—On Wednesday, Dec. 6, T. F. Goddard, Esq., on the Analogies of the Vegetable and Animal kingdoms, and the Polarization of Light.

*City of London Literary and Scientific Institution.*—On Wednesday, Dec. 6, at eight o'Clock precisely, Thomas Webster, Esq., on Geology.

*Milton Literary and Scientific Institution*, Milton-street, Cripplegate.—On Monday, Dec. 4, at half-past eight o'clock, Rev. Dr. Hoppus, on the Philosophy of the Human Mind.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—It is well known that a poker when placed across the fire creates a more rapid combustion of the fuel. Could "J. R. Watts," or "Q. E. D.," or any of your correspondents, tell me how the poker produces so remarkable a phenomenon?

A. R. Y. Z.

Sir,—Being in the trade of brass tube making, and having the opportunity of a commanding view of the country, I should feel greatly obliged to any of your Correspondents who can inform me how a four-feet telescope can be made, and what kind of glasses I should purchase. I had the gratification of looking through a four-feet telescope with a piece at the end to adjust to the sight, which answered well.

A Constant Reader.

Sir,—I should feel obliged if any of your numerous Readers would inform me of the best method of colouring gold watch dials.

J. Wells.

Sir,—Having succeeded very well in procuring oxygen from chlorate of potash, I was desirous to obtain it from black oxide of manganese, reduced to a paste by the addition of sulphuric acid, both by exposing it in a retort to the heat of an Argaud lamp; and also in a gun-barrel (with a bladder attached for the reception of the gas), to the heat of a very hot fire. In neither of the latter cases have I been able to succeed. In the last case I did not add the sulphuric acid, a thing which I ought perhaps to have mentioned.

After having procured hydrogen gas, on trying to crystallize the sulphate of zinc, from what fault in the operation is it, that, instead of forming regular crystals, it rather assumed the appearance of a mass of white sugar?

Tyro.

Sir,—Might I trouble you to insert the following queries.—1. How can I break off the neck of a bottle in order to make it shorter for an electrical machine.

2. Which is the best way of keeping the stand of an electrical machine together, which is nearly cracked in pieces, so as not to interrupt the operation of experiments.

3. Would "Brack" be kind enough to tell me if it be *necessary* that the size of a pneumatic trough should be in the same ratio as the one he describes.

J. C. Junr.

Sir,—Could you or any of your Readers give me an answer to the following Queries; as you have a great number pray excuse the trouble from

Your obedient Servant,

Charlemagne.

1. Where is philosophical apparatus lent on hire?

2. Have any of your Subscribers an electrical apparatus to dispose of, and at what price?

3. Where are geological specimens to be bought at the cheapest rate?

4. Is there an institution in London devoted exclusively to the studies of chemistry, and natural philosophy; and if not, what institution has the best apparatus?

5. What is the subscription to the Royal Institution?

6. Is the electro galvano magnetic carriage described in a former Number likely to come into use, and has there been any improvement thereon?

## ANSWERS TO QUERIES.

If "A Young Chemist" will take a ginger-beer bottle to an iron-founder, he will cast him one in iron from it for about eight-pence; and he can procure a foot or so of iron tube from any ironmonger's for a few pence, and a blacksmith will screw them for him. A length of flexible pipe can be bought at Warne's, Jewin Crescent, and the whole expense will not be more than two shillings.

"Pivot" is informed that Watch and Clock-Makers use neats-foot oil, in which lead shavings have been for some time suspended. This is their universal remedy, and a celebrated house in Bond Street, sell this famous chronometer oil at 1*s.* 6*d.* per dram.

C. D. Thomas.

One of the Correspondents of your clever work asked some time ago how fast Eight ounces of Iron could be melted. I beg to tell him that Atkin's Portable Blast Furnace, price 21*s.*, to be bought at Knight's, Foster-lane, Cheapside, with a pair of double bellows, will melt iron in fifteen or twenty minutes.

"A Constant Reader," No. 48.—*How to make Black and Blue Reviver*:—Boil three ounces of Logwood chips, and one ounce each of gall, green vitriol, iron-filing and sumach, in a quart of vinegar for a short time, then strain the liquor, and keep till required for use.

"A Subscriber," No. 54.—*To make Permanent Red Ink*:—Boil four ounces of Brazil powder, and one ounce each of crystals of tartar and powdered alum, in a quart of river water, till half the fluid is evaporated. While it is yet warm, dissolve in it one ounce each of sugar and gum arabic. This will produce an ink of a lively red hue, and very permanent.

*Blue Ink.*—Take some Prussian blue in powder, and with a sufficient quantity of gum-water to produce the required depth of colour.

A. B. Y. Z.

## TO CORRESPONDENTS.

*A part of the Query sent by* A. X. *is so obliterated, as to render it unintelligible.*

E. *will find his first two Queries were in a recent Number of the Mechanic.—Dr. Church's Steam Carriage was considered a failure. The idea of a coach running on three wheels was ridiculed.*

Geleso. *We occasionally give Biographical Sketches of Scientific Men; and shall be glad to receive any interesting facts on the subject.*

*We will make further inquiries on the subject mentioned by* E. N.

*The amusing papers on Railroad Travelling, next week.*

John S. Holland's *Steam Boiler is well deserving of notice. The article shall appear in our Magazine.*

Mr. Thomas *must blame our Engraver, for delaying the wood-cut.*

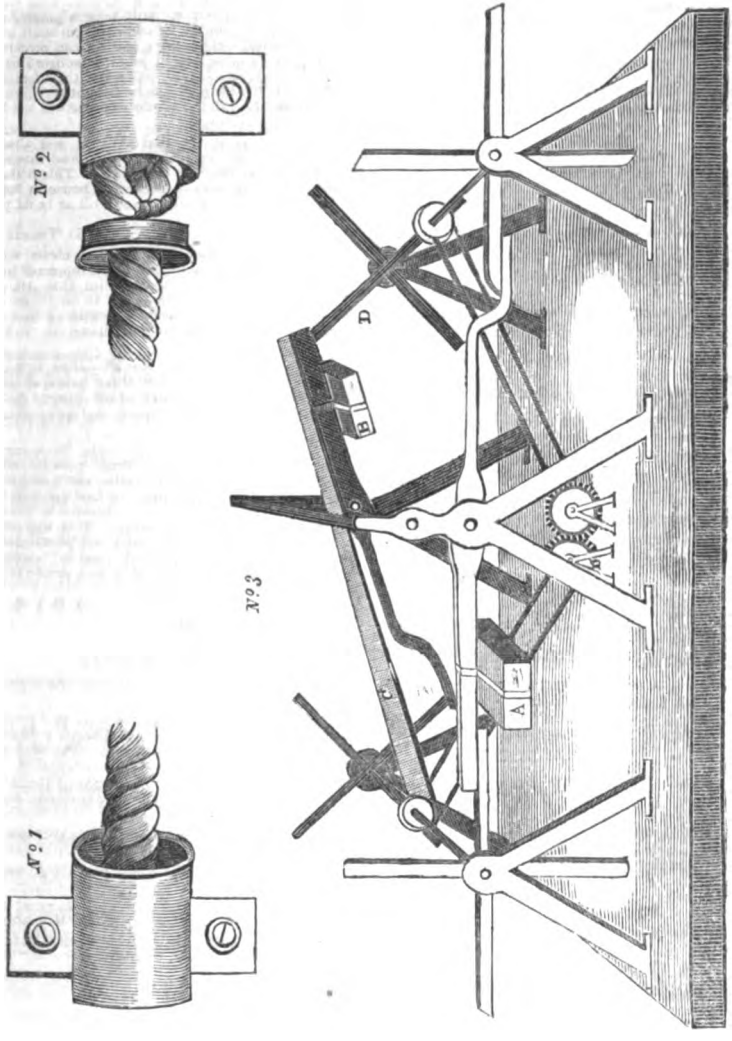
*Received* "Charlemagne."—"S."—"X. Y."—"Subscriber," *and several others.*

London: Printed at the Holloway Press, by D. A. Downey; where all Communications are to be addressed (post paid); published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC
## AND THE CHEMIST.

No. LIX.] SATURDAY, DECEMBER 9, 1837. [Vol. II.


WINDOW SASH SUSPENDER.

PERPETUAL MOTION.


Vol. II.— No. LIX.

Holloway Press: D. A. Doudney.



Digitized by Google

## ATTEMPT AT PERPETUAL MOTION.

*To the Editor and Readers of the Penny Mechanic.*

SIR AND GENTLEMEN,—Many years have passed since I became satisfied in my own mind that the mechanical philosopher's stone—perpetual motion—was not destined for *my* discovery. Infants (and amateurs of all grades are mere infants) dream they can do wonders, until experience, with a scholastic ferrula, beats about their brains, to remind them the proper lesson has been neglected. But have I therefore fallen into the ranks of those who decry the attempt to obtain a self-moving piece of machinery as illusory? Certainly not. On the contrary, my belief that this *ne plus ultra* of mechanism is capable of attainment, and will one day cause a revolution in the affairs of the world to which we have no parallel but the success of the steam engine, is as perfect as ever: fire cannot melt the belief out of me; I shall live and die in it. Come, let us all look the subject right in the face.

The slow coachmen, who are so nervous and angry at the base idea of perpetual motion, or the motion of a self-moving machine, which, besides working it self, isto create an overplus of power, attempt to put an extinguisher on the possibility of its discovery, by begging the main question respecting it. They say thus:—Machinery cannot *create* power; it can only *concentrate* it; and unless the power which first starts a moving machine be continually renewed, the machine will come to a stand still by gravitation.

I cannot choose but laugh when I think this is *all* the pith of the thousand and one treatises against the mechanical Jove.

Really, gentlemen (I hope some of the slow coachmen are reading this), it is *too* bad for you first of all to set your scientific faces against a self-moving machine, and then to speak on the subject as if you knew how such a thing *must* be constructed to be constructed at all. To lay down the law, forsooth, that there is but one old quagmire of a road, and that whoever seeks the perpetual must seek it up to his knees in impossible theorems, is really *too bad*. Why should we be called upon to believe that every man who tries to make a self-moving machine, must, by stern necessity, be compelled to attempt it on the precise plan you lay down as the only possible one? Our grandsires said there could be no floating in the air by bipeds without wings; and no travelling on a road at a rate exceeding the speed of an ostrich. The old perriwigs never thought of balloons, or of big Sampson, the locomotive.

Let us fancy a man who had never seen a hand-mirror;—some "learned Theban," vegetating in a country not yet visited by the European,—and let him be asked his opinion of such a contrivance for looking into the back of our mouths, and you would have the same sort of treatise as the slow coachmen give on the subject of perpetual motion: e. g. "The idea of a hand mirror is absurd: the only mirror we know of in nature is water: now water cannot stand up perpendicularly, and, therefore it is folly to suppose we can make a hand mirror." Now let us bring up the ghosts of all the persons who have assisted in the inventions of steel mirrors and looking glasses, and hear *them* speak:—'Ignorant Savage! because you never saw but one mirror, and that one a water course, lying horizontally on the earth, you conceive it impossible that man should be destined to discover in the iron dust of the earth, in the most unlikely pebble, and the sand of the shore, the means of showing you your ugly countenance, looking up ever so perpendicularly. Look here, you cannibal, at this two-and-sixpenny shaving glass, and never again have the presumption to question the power of man over inanimate matter."

Now, Sir, I wish it to be distinctly understood that this very identical savage neither believed in the Vauxhall Nassau balloon, nor in the American diving apparatus. He was a poor lost heathen, and neither believed in railway speed, power looms, the magnetic needle, nor the electro magnetic. And yet said there should be no looking glasses! Let us all laugh outloud at this, and then allow me to say a word or two about my old scheme for a self-moving machine.

Be so kind, dear reader, as to look at the engraving and read the description.

Thank you. Now do me the justice to observe that if the machine will *not* move it is not *my* fault. I have done all *I* could to make it move, but failing in the attempt I now hand it over to you for a little (very little) castigation and improvement. To make it move it only wants a —— a —— a —— you understand me? *That* I wish you to put to it, for I wash my hands of the whole affair. But whatever you do in this business never forget the long box with the weight in it. That weight coming down on a lever *before* the leaver touches the spoke of the wheel is just

Digitized by Google

worth a thousand pounds, because it is out of the pale of all the theorems laid down so impertinently by the slow coachmen for the guidance of us ill-used perpetual motion seekers.

Gentlemen, let who will contradict me, I assert that a falling weight is a machine *creating power*; and if three of these creating powers are so managed that two of them shall balance each other, while the third is at work, *making gravitation*, and if you can change their relative positions, why you have a self-mover, or perpetual at once, slap bang. This is the principle of my attempt. And you who are smiling at the idea of a self-moving machine which will *not* move, look at the contrivances, and see if they may not be turned to good account for some other purpose than they were intended.

I am, Sir, and Gentlemen,

Your obedient servant,

G. P. P.

DESCRIPTION.—Here you have two long levers with a weight to each (A and B.) You have a box (C) suspended from its middle, and containing a large iron ball, three-fourths as heavy as either of the weights to the long levers. Pull up either of the levers, and then let it fall, and over comes the box, rolling the weight inside it over and over, and increasing the gravitation in that quarter 75 per cent. Very good. Now cast your eyes to the four corners of the platform, and you will see four *things* in the shape of crosses; two of these crosses (square at the extreme ends) receive the long levers when the levers fall; the other two (tapering at the extreme ends) are grooved spokes to press down the thin ends of the long levers. On the same two *axes* upon which run the four crosses are two drums for the receipt of bands, which bands run also round the cogged wheels seen in the centre of the platform. Now, suppose the machine to be in the position represented in the diagram. Well, down comes lever B, pulling over the weight in box C, and falling on the spoke D, turns the cross to which D belongs, as well as all the rest of the machinery, by means of the grooved spokes, the bands, and the cogged wheels. Not much turning is there, however, before lever A has been lifted so high that it cannot choose but fall, and pull over the weight in box C, after the same fashion that not many seconds before had been adopted by lever B; and pulling up lever B, lets it fall again, thus producing that see-saw movement, which (in this machine) is so absolutely necessary for self-motion.

## WINDOW SASH SUSPENDER.

*To the Editor of the Penny Mechanic.*

SIR,—The tube by which a common Tin Lamp is supplied with oil, suggests such a cheap, simple, and effectual mode of suspending and detaching the window sash, that I am induced to send a drawing with a slight alteration for that purpose. No. 1 is a representation attached, No. 2 detached, and consists of a Brass Tube, one-inch in length and half-inch diameter, with a screw top similar to the Lamp Tube, through a hole in which the sashline passes, and is secured by the knot I have introduced, an arm on each side up to which it must be let into the plough groove, and screwed to the sash, when, by only unscrewing the top, the line will be detached.

Yours, &c. ENTITY.

## ANSWERS TO THE QUESTIONS IN No. 52.

### QUESTION 2.

*Is the flame of a candle translucid? that is, does it admit of free passage of rays proceeding from other luminous bodies?*

Flame is in itself perfectly translucid; it is a development of light and heat, neither of which are found to affect in any way the passage of even the smallest ray of light; the black opaque particles which form the smoke, are imperceptible in a bright flame. If two candles be so placed that the light of one shall throw the shadow of the other against a white surface, the shadow of the wick will be seen. but no shadow of the flame will be visible, therefore the rays proceeding from the distant candle, are not diminished by passing through the flame of the other. Distant objects are not visible through the flame, because their fainter light is overpowered by the greater,—in the same manner that the light of the stars is overpowered by the greater light of the sun; but an object placed near the flame, or a distant object if sufficiently luminous, may be seen distinctly through the flame. The flame is hollow; the gas is given out from the tallow before it attains a sufficient degree of heat to cause combustion; and the force with which it is projected, prevents the flame from approaching the wick. This is the reason that the wick

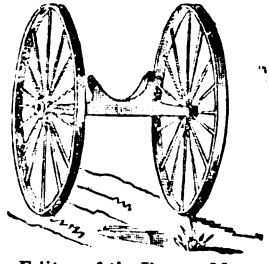
Digitized by Google

is not consumed, but remains charged with carbon, at the upper part of the flame until it falls, and frequently ignites the tallow, if not snuffed off. If, instead of placing a candle upright, it be inclined in the direction of a poker placed with the lower end, about 8 or 10 inches from the corner against which it rests, the snuff will not accumulate, but fall in an almost imperceptible white ash as fast as it protrudes through the burning surface of the flame; in this state, a candle may be left to burn out without danger of accident. The cause of the flame inclining upwards is the rarifaction of the air by heat, producing an ascending current which carries the flame with it. Q. E. D.

*To the Editor of the* PENNY MECHANIC.

SIR,—I beg to call the attention of practical men to a method of describing elliptical arches by W. H. in No. 56. The curve described in fig 4, is precisely the same as that produced by the common method; but W. H.'s invention, renders the execution *more accurate and expeditious*. On fig 2 take a point (P) in the line 3, 2, * making P 2 to 1, 2, as P 3 is to 3, 1; by similar triangles it will be seen that the locus of the point P, is a curve similar to that described by the point 1; P 2 being the height, and twice P 3 the span. The function of the line 3, 2, is the same as that of d c in fig 4. I have explained this method to a practical man, who prizes it as valuable information. He requests me to express his thanks to the inventor, to which allow me to join my own. Q. E. D.

## VELOCIPEDE.



*To the Editor of the* PENNY MECHANIC.

SIR,—A sailor has been travelling about London on a machine no less ingenious than novel, a description of which may not be uninteresting to some of your readers. It has two wheels of very light construction, about 10 feet in diameter; on the axle is fixed a cushion, and two padded elbows. The man sits on the cushion, and by the help of his feet urges himself forward at the rate of 9 miles per hour. FORMATOR.

* Never employ numerical figures as signs; it occasions unnecessary confusion.

## RAILROAD TRAVELLING.

ALTHOUGH the whole passage between Liverpool and Manchester is a series of enchantments, surpassing any in the "Arabian Nights," because they are realities, not fictions, yet there are certain epochs in the transit, which are peculiarly exciting. These are the startings, the ascents and descents, the tunnels, Chat Moss, and the meetings. At the instant of starting, or rather before, the automaton belches forth an explosion of steam, and seems for a second or two, quiescent. But quickly the explosions are reiterated, with shorter and shorter intervals, till they become too rapid to be counted, though still distinct. These belchings or explosions, more nearly resemble the pantings of a lion or tiger, than any sound that has ever vibrated on my ear. During the ascent they become slower and slower, till the automaton actually labours like an animal out of breath, from the tremendous efforts to gain the highest point of the elevation. The progression is proportionate; and before the said point is gained, the train is not moving faster than a horse could pace, with the slow motion of the animated machine, the breathing becomes more laborious, the growl more distinct, till at length the animal appears exhausted, and groans like the tiger, when nearly overpowered in contest by the buffalo.

The moment that the height is reached, and the descent commences, the pantings rapidly increase; the engine, with its train, starts off with an augmenting velocity; and in a few seconds it is flying down the declivity like lightning, and with a uniform growl or roar, like a continuous discharge of distant artillery. I was on the outside, and in front of the first carriage just over the engine. The scene was magnificent, I had almost said terrific. Although it was a dead calm, the wind appeared to be blowing a hurricane, such was the velocity with which we darted through the air. Yet all was steady; and there was something in the precision of the machinery, that inspired a degree of confidence over fear—of safety

Digitized by Google

over danger. A man may travel from the pole to the equator, from the Straits of Malacca to the Isthmus of Darien, and he will see nothing so astonishing as this. The pangs of Etna and Vesuvius excite feelings of horror, as well as of terror; the convulsion of the elements during a thunder storm, carries with it nothing of pride, much less of pleasure, to counteract the awe inspired by the fearful workings of perturbed nature; but the scene which is here presented, and which I cannot here adequately describe, engenders a proud consciousness of superiority in human ingenuity, more intense and convincing than any effort or product of the poet, the painter, the philosopher, or the divine. The projections, or transits of the train through the tunnels or arches, are very electrifying. The deafening peal of thunder, the sudden immersion in gloom, and the clash of reverberated sounds in confined space, combine to produce a momentary shudder, or idea of destruction—a thrill of annihilation, which is instantly dispelled on emerging into the cheerful light.

The meetings or crossings of the steam trains, flying in opposite directions, are scarcely less agitating to the nerves than the transits through the tunnels. The velocity of their course, the propinquity or identity of the iron orbits along which these meteors move, call forth the involuntary but fearful thought of a possible collision, with all its threatening consequences. The period of suspense, however, though exquisitely painful, is but momentary; and in a few seconds the object of terror is far out of sight behind.

The first-class or train is the most fashionable, but the second and third are the most amusing. I travelled one day from Liverpool to Manchester in the lumber train. Many of the carriages were occupied by the "swinish multitude," and others by a multitude of swine.—These last were "neat as imported," from the Emerald Isle, and therefore were naturally vociferous, if not eloquent. It was evident that the other passengers would have been considerably annoyed by the orators of this last group, had there not been stationed in each carriage, an officer somewhat analagous to the Usher of the Black Rod, but whose designation on the railroad I found to be "Comptroller of the Gammon." No sooner did one of the long-faced gentlemen raise his note too high, or wag his jaw too long, than the "Comptroller of the Gammon" gave him a whack over the snout with the butt end of his shillelagh; a snubber that never failed to stop his oratory for the remainder of the journey.

A CONSTANT READER.

## CITY OF LONDON LITERARY AND SCIENTIFIC INSTITUTION.

SUBSCRIBERS are entitled to the following advantages:—The use of an extensive Library for Circulation and Reference, consisting of the principal Standard Works in English and Foreign Literature, and already comprising more than 6000 volumes. Reading Rooms, supplied with the Morning and Evening Papers, Periodical Publications, and new works of interest. Lectures on the various branches of Science, History, and Polite Literature. Classes for Instruction in Mathematics, and Drawing—in the French, Italian, German, Greek, and Latin Languages—for the full attainment of the French Language by Conversation—for improvement in Elocution—for the discussion of Historical and Philogical Subjects—for the pursuit of Philosophical Enquiry, and for the Study of Phrenology. Private classes for the study and practice of vocal and instrumental music.

A Museum of Natural and Artificial Curiosities is in progress, under the superintendence of the Committee of Management.

n

THE TERMS OF SUBSCRIPTION

To this Institution are as under:—Two Guineas Annually; or eight Guineas, and One Guinea annually; or Twenty Guineas in lieu of all future payments. Subscribers of Twelve Guineas, and One Guinea annually; or of Five Guineas, and Two Guineas annually, are entitled to introduce a Lady or Gentleman to the Lectures. Subscribers of Ten Guineas, and One Guinea annually; or of Three Guineas, and Two Guineas annually, are entitled to introduce a Lady to the Lectures. Lady's Subscription to the Lectures, One Guinea annually; or to the Library and Lectures, One Guinea and a half annually.

## STRIKES.

*To the Editor of the* PENNY MECHANIC.

SIR,—If the following answer to the letter of J. F. S. on the subject of strikes be thought explicit enough for your excellent publication, you will give me great pleasure in inserting it. Your correspondent in the first, professes to lay down the manner in which strikes are brought about, in which, I think, he is very right, but in the way he would obviate, or remedy the evil, I must beg leave to differ with him.

Digitized by Google

In one part of his letter he advises the workman to continue working, actually under the oppression and injustice of their employers, and in the same breath he uses this expression, "I am not one to advise any man, or any body of men, to submit tamely to oppression and injustice from whatever quarter it may come, when there is any remedy open to them;" and then he points out a remedy which is in itself objectionable. A trade society consisting of 6 workmen and 6 masters, is all very well, but when he puts a master in the chair, thereby giving a majority in favour of the masters (who are in themselves a majority, by being more wealthy, and more independent than the workmen,)—I cannot but think the trade and the workman would be in a worse condition than under any circumstances which have formally appeared in England; their decision could not be against themselves, for the casting vote would be always in their favour; but if you have but 12 members, and from that 12 choose a chairman, then the thing might be brought on a better footing, and a nearer equality, for why should the master who always receives his due from his workman, be given such an advantage over the mechanic?

That strikes never can do good to the operative or the country at large, I agree with "J. F. S." for the operatives are the producers of the wealth of the nation, and when their labour ceases, the country must receive a severe shock, but when he asserts that they resort to gin shops, I think he must hold the character of the mechanic in low estimation, by the many, for the vices of the few, for when work is offered to the majority of mechanics, I am happy to say that they willingly do their best to restore their masters' confidence. All strikes that have been made within the last five years have been badly managed, or they must have succeeded.—Among them were too many masters who manned the whole, and thus set aside that good that would most certainly have arisen, had they but have listened to their Directors.

A. W. C.

*Extraordinary Leap from a Ship's Mast.*—On Tuesday last upwards of 100,000 persons assembled at the Waterloo Dock, at Liverpool, to witness an extraordinary feat by Samuel Scott, a native of Philadelphia. At 12 o'clock he ascended the rigging, and amidst the shouts and cheers of the immense multitude, plunged headforemost into the basin from a height of 193 feet. At half-past two he announced another leap, which was accomplished without accident. Money was collected for him among the spectators. This has been one of the most astonishing feats ever recorded.—*Patriot.*

*Colossal Vegetables.*—There are at present in our office, for the inspection of the curious in horticultural matters, a colossal cabbage, and a no less colossal Swedish turnip, sent us by a friend in the neighbourhood, as Goldsmith sent a cut of his venison to Reynolds—"to paint it or eat it, just as he liked best." The cabbage weighs 53 pounds, and measures (although considerably compressed in the packing) 2 yards 15 inches in horizontal, and 1 yard 3½ inches in vertical circumference. We defy all the tailors in Glasgow to make up as great a bulk of solid cabbage by their united efforts for a month. If we boil it, we must borrow a steam-boiler. The Swedish turnip is equally uncommon in its dimensions, measuring 28 inches in circumference, and weighing 14 pounds. The assembled *posse comitatus* of the establishment gazed in silent astonishment on these wonders when the staves of the cask were knocked from about them, until the spell was dissolved by the youngest imp sighing audibly—"Lor', they've forgot to send the beef."—*Glasgow Argus.*

*Railroads.*—Select committee appointed "to consider the present state of the communications by railroads, so far as it affects the regularity and convenience of the transmission of letters, and the Post-office in general; to ascertain on what terms mails are now conveyed by the railroads in operation; and what measures it may be just and expedient to adopt, for the purpose of securing to the public in future the benefit of the conveyance of the mails by railroads."—Mr. Baring, Mr. Wallace, Mr. Labouchere, Lord Viscount Lowther, Mr. Gillon, Lord Viscount Sandon, Mr. Hutton, Mr. Scholefield, Mr. Greene, Lord Seymour, Mr. Easthope, Lord G. Somerset, Lord C. Fitzroy, Sir R. Fergusson, Mr. Loch. Power to send for persons, papers, and records. Five to be the quorum.

*Greenwich Railway.*—Mr. Mackintosh has commenced operations for the arches between the Ravensborne and Greenwich; so that all doubt will be removed as to its completion into Greenwich. Should the weather remain open during the winter, the works are expected to be finished in the spring. It appears that the Croydon Railway will commence running in May next, which must greatly benefit the Greenwich line.

Digitized by Google

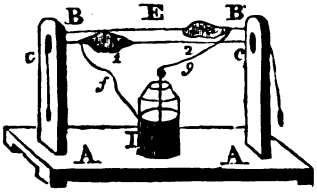
# THE CHEMIST.

## THEORY OF THUNDER CLOUDS.

*To the Editor of the* PENNY MECHANIC.

SIR,—Perceiving in some of the later numbers of your useful publication, a description of experiments in electricity—I take the liberty (as a dabbler in that science) to send you herewith a drawing of a piece of apparatus used to illustrate Franklin's theory of thunder clouds, to which, if a place in your valuable and highly popular Magazine should be allotted, a great obligation would be laid on your subscriber and well-wisher,

W. BURBIDGE.




*Description.*—A A is a wooden stand, a foot long and two inches wide, on which are erected uprights B B; C C are two small pulleys over which a silken cord D can pass easily, E is another silken line stretched across from one upright to the other, on these silken cords, two pieces of thin card-board (covered with tin-foil, and so cut out as to represent clouds), are to be fixed horizontally and made to communicate by means of the thin wires f and g, one with the in and the other with the outside of a charged jar I. Now by pulling the loop of the silk line D, the cloud 1 will be brought near the cloud 2, continue this action slowly until the clouds (which are furnished with two small brass balls) are within an inch of each other, when a beautiful flash (strongly resembling lightning in miniature) will pass from one cloud to the other.

If the jar I be put behind and the cloud 2 removed, a vessel communicating by means of a wire with the outside of the jar may be swam in water under the remaining cloud; the mast being made of separate pieces, and but slightly joined together; when the cloud is passed over the vessel, the mast will be struck and shattered to pieces. A basin may be substituted for the vessel; it must be constructed of paper steeped in turpentine, a brass ball covered with wool, on which powdered resin has been sprinkled, must be fixed at the top. When the cloud is made to pass over this, this flash will fire the resin on the wool, which will communicate with the rest of the inflammables; the jar must be charged with electricity previous to the performing of either of these experiments.

*Sugar of Lead.*—Take of white lead a pound, strong acetic acid a pint, boiling distilled water a pint and a half, mix the acid with the water, to these gradually add the white lead and boil until the acid is saturated, then strain through paper, and the water being evaporated until a pellicle is produced, set aside that crystals may be forme, the liquor being poured off dry these upon filtering paper.

J. R. WATTS, M. D.

*Concentric Galvanic Piles.*—M. Jules Guyot has just announced the construction of galvanic piles of a particular form, which he calls concentric piles. In these piles one pole is at the centre, and the other at the circumference. New properties and remarkable analogies are said to result from this combination; as we find at the surface of spherical piles made to revolve, all the influences of gravity and terrertrial magnetism at the surfaee of our globe. A pile four inches in diameter, composed of concentric cylinders two inches high and six in number, being charged with pure water, gives strong shocks even after the lapse of twenty-four hours.

*Mercury in Urine.*—Dr. Cantu sometime ago examined the urine of persons who had used a considerable quantity of mercury by means of friction. From 60 lbs. of the fluid, he obtained a large precipitate; but after it had been separated, the liquid gave no trace of mercury. The precipitate, mixed with powdered charcoal, was exposed to the action of a red heat in a glass retort, its mouth terminating in a receiver filled with water. At the end of the operation a powder was found at the bottom of the receiver, which, on being dried, gave globules of mercury by pressure. From the whole 60 lbs. about 20 grains was obtained.—*Mem. de Turin, vol. xxix. p.* 228.

*Fossil Copal, Highgate resin.*—A pale, yellow-brown, muddy substance, found in the bed of blue clay at Highgate. It has a resinous appearance, and when heated, gives out a resinous odour, melts into a fluid, takes fire at a lighted candle, and before the blow-pipe is wholly consumed.

Digitized by Google

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*Southwark Astronomical Society*, Nelson-street, Long-lane.—On Friday, Dec. 15, at eight o'clock precisely, Mr. Ogilvie, on Electricity.

*Southwark Literary Society*, No. 37, Bridge-house Place, Newington Causeway.—On Wednesday, Dec. 13, T. Adams, Esq., on Music.

*City of London Literary and Scientific Institution.*—On Wednesday, Dec. 13, at eight o'Clock precisely, Thomas Webster, Esq., on Geology.

*Milton Literary and Scientific Institution*, Milton-street, Cripplegate.—On Monday, Dec. 11, at half-past eight o'clock, Rev. A. Fletcher, M. A., on the Fulfilment of Prophecy.

*Mutual Instruction Society*, No. 16, Great Tower-street.—On Monday, Dec. 11, at eight o'clock, Mr. J. Robinson, on Optics.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—I should feel much obliged by any of your Correspondents informing me of the best way to prepare Paper for Water-colours: also the best preparation for a Varnish for the same.

L. D. POPLAR.

Sir,—If any of the Readers of your clever little Magazine could inform me how to make an Astronomical Refracting Telescope (of rather a great power), I should feel greatly obliged. Also of the simplest method of making an upright and portable stand to use, in a garden, and the price it could be made at.

SIGMA.

SIR,—Can any of your Readers inform me of a cheap work giving a discription of Ancient Greecian and Roman Coins?

S. T. COOPER.

SIR,—I should feel obliged if any of your Readers would inform me the best way to mend a Cut Glass Tube broken in half.

R. H.

SIR,—Can any of your Readers inform me where I can obtain a Watch with Berolla's Patent Alarum movement, in which, by the withdrawing of a small pin, any alarum may be set off; and what will be the probable cost of one in a silver case? Also the best house for purchasing very slight Clock Springs?

O. Z.

SIR.—Can any of your Readers inform me how to make Phosphorus; I have heard that calcined oyster-shells will make it, but in trying the experiment I failed.

C. BONEY.

SIR,—Can any of your intelligent Chemical Correspondents inform me how I can make a good Tracing Paper. I have two receipts, but neither of them accomplish the desideratum, viz. a clear paper, and a surface that will take a fine ink line from a steel drawing-pen, equal to one on drawing-paper. Your insertion of the above will oblige a regular subscriber.

INQUISITOR.

## ANSWERS TO QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—"Mercury," in Number 53 of your valuable Magazine, asks for some simple experiments that can be performed with the cheap electrical apparatus, I subjoin the following few, in the hope, they may be of service to him.

Put a little piece of cotton, or small downy feather, on the palm of your hand, and hold it three or four inches from the prime conductor, turn the handle of the machine, and the feather or cotton will fly from the hand to the prime conductor, and from the prime conductor to the hand, with a quick motion. This will continue as long as the handle of the machine is turned.

Let a person stand on an insulated stool (such as described in Number 55) and hold a piece of silver between his teeth, so that his lips do not touch it; then if another person not insulated, take a spark from it, the sensation will be so severe that he will be obliged to let it fall.

Warm the bowl of a silver spoon, and fill it with highly rectified spirits of wine; let a person who is insulated hold the spoon in his hand, and another person take sparks from the spirit, which will immediately ignite.

Insert two wires in opposite directions in an orange, so that the points shall come near each other, electrify the wires, and the orange will appear quite transparent.—This must be done in a darkened room.

Suspend a metal plate from the prime-conductor, and another three or four inches beneath it, connected by some conductor with the ground. On the lower plate place some paper figures of animals; turn the machine, and they will rise up and dance.

Yours, &c.

SIGMA.

"A Miltonian,"—Mr. W. Hawthorn, of Forth, Newcastle, has invented a very clever piece of machinery for clearing the Rails; but how far this, or the weight of the engine itself, will answer in clearing away heavy falls of snow, time alone will show.

2nd. It is on account of the quantity of antimony used in printer's type that makes it injurious; especially when used while warm.

SIR.—Allow me to state that the Correspondent, who, in the last week's Number gave directions to "A Young Chemist," relative to the purchase of an Iron Bottle, is in error. In the first place, no iron-founder will cast the bottle under four or five shillings; and the tube would at least cost nine-pence the foot. In the second place, a screw in its socket subjected to the fire so expands it, as to exclude all possibility of unscrewing it.

I am, Sir,

Yours truly,

J. EVANS.

"J. C. Junr." Nbmber 58, Penny Mechanic. Twist a piece of whipcord round the neck where you wish it to part, and keep it in a sawing position; in a few minutes it will become heated by the friction of the string, then dip it suddenly in cold water, and it will instantly part.

L. D. POPLAR.

## TO CORRESPONDENTS.

T. S. Cooper *is altogether mistaken in his supposition The Nassau Balloon was not held to the earth by one-tenth part the weight of Mr. Cocking and his parachute. He need not therefore be surprised that the balloon did not rise as rapidly from the Gardens as it did when separated from the aeronaut and his machine at an altitude of 5000 feet. Balloons frequently rise from the earth with basely an ascending power.*

*As, no doubt, some of our scientific friends are making experiments on the Electro-Magnetic Engines (of which N. Callan, of Maynooth College has just sent such a flattering account before the public) we shall feel obliged to any of them who may be pleased to send us an account of the progress they have made in this infant machine.*

"Entity's" *Letter shall be inserted; although we must beg leave to differ in opinion as to the general result.*

*Received* "J. T. Q." *on Electricity of the Watch.*—"C. Parke, &c."

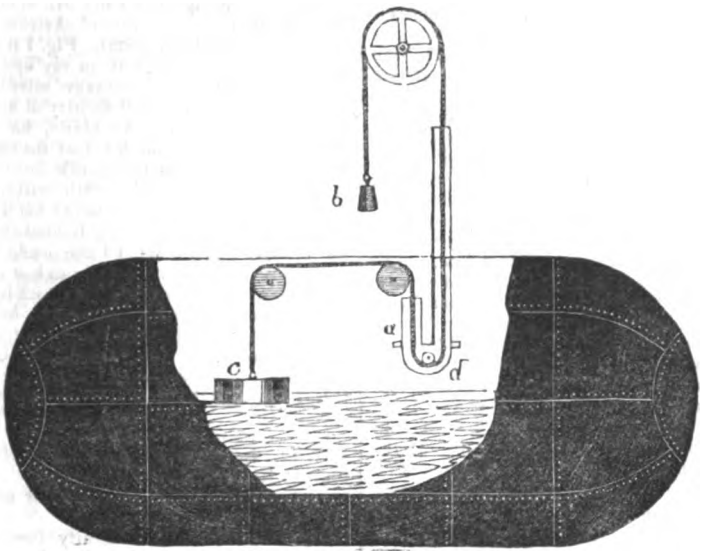
London: Printed at the Holloway Press, by D. A. Doudney; where all Communications are to be addressed (post paid); published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LX.] SATURDAY, DECEMBER 16, 1837. [Vol. II.

### WATER GAUGE FOR STEAM BOILERS.




### BOW SAWS.

FIG 1.

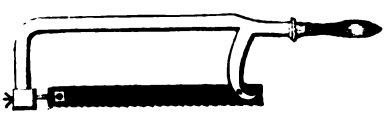


FIG 2.

Vol. II.—No. VIII. Holloway Press: D. A. Doudney.

Digitized by Google

## ANSWERS TO QUSTIONS IN No. 52.

QUESTION 3.

*When a solid sphere revolves about an axis passing through its centre of gravity, does the centre of gravity revolve?*

Certainly not; rotation is a motion of the parts of a body about an axis; the centre of gravity being *a point*, has no parts, and therefore cannot revolve. Many persons find a difficulty in understanding the true definition of a point: it is not an infinitely small space, but *no space at all*; if two ends of a line be made to meet, the place where they meet is called a point, and there can be no space between two things which touch each other. If the sphere revolve round a fixed cylinder, the rational axis and centre of gravity will both lie within that fixed body, and if the sphere be hollow, the centre of gravity will be a point within the hollow space. The idea of a point being a particle of matter, or space, though entertained by many who are unskilled in geometry is as gross as it would be to look for the lines of latitude and longitude on the surface of the earth.

It may also be proper to observe, that when a body revolves about an axis lying within that body, every particle of matter contained therein, is in motion; the adjacent particles revolving round that part of their surface which coincides with the axis of motion. Q. E. D.

## WATER GAUGE FOR STEAM BOILERS.

*To the Editor of the Penny Mechanic.*

SIR,—During the excitement caused by the bursting of the boiler of the Hull steam boat, it occurred to me, that a very effective water gauge for steam boilers might be made in the way shown in the annexed drawing: a a are two tubes attached to the box d, which contains a friction roller, the dotted lines represent a small chain fastened at one end to the balance weight b, and at the other end to the float c, the tubes to contain mercury to the level of the top of the short tube. The use of the mercury is to prevent the steam from blowing out, and when high-pressure steam is used, the size of the tubes must be proportioned to the pressure used; for instance, if the steam is required of fifty pounds pressure on the square inch, it will require a column of mercury in the long tube, of one hundred and three inches in height, and the short one must be large enough in the bore to contain the mercury, when it descends after the pressure is removed.

It will readily be seen that as the water rises or falls, the float must do so too, and consequently the balance weight b.

I remain, Sir, your humble servant,

JOHN S. HOLLAND.

26, Windsor-street, City-road.

## BOW SAWS.

*To the Editor of the Penny Mechanic.*

SIR,—I have sent you two sketches of bow saws for cutting metal. Fig. 1 is the plan in universal use, but in my opinion there is a great disadvantage attending that form, which is the difficulty of using the whole length of the blade, for the handle being above the level of the teeth, when the end nearest the handle comes to bear upon the work, the teeth will stick fast in it from the pressure being too much over them, instead of being behind them. To remedy this defect, I have made one according to fig. 2, which, though it may not look quite so elegant (but which is all a matter of fancy), works much better from the handle being in a straight line with the teeth. J. H. C.

## ON THE STUDY OF MECHANICS.

NO. VI.

(*Continued from page* 133.)

DEF. 17. *Infinity* is the postulatum of unlimited licence to suppose a process continued, are a quantity increased or diminished to any required extent.

The false doctrine of infinity has been so long corroding upon truth and reason, and its ramifications are so interwoven with mathematical science, that nothing short of a potent and determined concurrence of the advocates of truth, is likely to effect its eradication. Infinity in its absolute and metaphysical sense, can only be conceived by some few powerful and lucid minds; and even these, aided by the utmost erudition, are unable to describe it in intelligible language. It is a subject which does not come legitimately within the province of calculation; though every one who has studied any branch of mathematical science, must have remarked the monstrous absurdities which are promulgated under the pretence of explaining it. According to the above difinition, infinity is merely a mental postulatum, and is not attributed to quantity, with which it is utterly incompatible; the difference is but a shade, and many gross minds will probably be unable to perceive it; but that shade separates truth from error. Relative or mental infinity, is a valuable auxiliary to calculation, and easily understood, when divested of the mysteries and contradictions which

Digitized by Google

invariably accompany the logicless speculations of metaphysicians. We may fairly suppose an unlimited license to encrease or diminish a quantity to any extent, which is all that is necessary for the purpose of calculation; for possessing this rational power, we may make a quantity approximate so near to o, that the difference becomes not only materially, but rationally imperceptible; we therefore consider it as equivalent to o; but we know that it is not equal to it, because o alone can be equal to o. But we cannot, if we think with propriety, assume the license of endowing quantity with infinity, and divesting it of all limits, which, when applied to matter, would deprive it of an essential attribute, and violate every uncontested definition.

Suppose a line (A B) to be made up of infinitely small parts; let p be one of those parts, and in their number; p is infinitely small, and n is infinitely great; but $p = n = A B$, therefore $\frac{A B}{n} = p$ must be a positive and perfect quantity, as much so as $\frac{A B}{5}$, or any other fraction of A B.

It is also asserted that n is infinitely great: it may be encreased to any required extent, but it cannot become boundless. The rational impossibility of making a quantity infinitely great may be proved as follows:—take any quantity (a) and produce an infinite and increasing series, as $a$, $a^2$, $a^3$, &c.; conceive these quantities to flow into a hollow elastic sphere; however, its size may be increased, it will always be a sphere, and having figure, it must have bounds, and therefore must still be quantity, and not infinity. It can differ in no respect from other quantities; it is only more vaguely expressed, its limits not being determined. To affirm that the *ultimate term* of a decreasing series which has *no end* is equal to o, is, besides the obvious contradiction, in the assertion itself, at variance with the hypothesis, which states that the quantity is continually decreasing, whereas o cannot be decreased. There are many ingenious contrivances to show that an infinite series ultimately arrives at the term to which it approximates; the following may serve as an example. Resolve the fraction $\frac{1}{3}$ into its corresponding decimal, ·333 &c. which is $\frac{3}{10} + \frac{3}{100} + \frac{3}{1000}$ &c.; suppose all the terms of this series to be multiplied by 10, and we have

$$10\,S = 3 + \tfrac{3}{10} + \tfrac{3}{100} + \tfrac{3}{1000} \text{ &c.}$$

Subst. $$1\,S = \tfrac{3}{10} + \tfrac{3}{100} + \tfrac{3}{1000} \text{ &c.}$$

$$9\,S = 3 + 0 + 0 + 0 \text{ &c.}$$

$$S = \tfrac{1}{3} + 0 \text{ &c.}$$

This result is obtained by misplacing the second line; it ought to stand thus:

$$10\,S = 3 + \tfrac{3}{10} + \tfrac{3}{100} \text{ &c.}$$

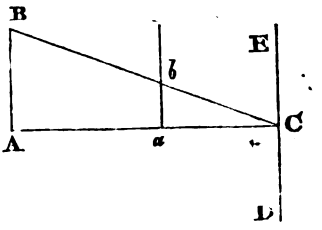
$$-S\ d = \tfrac{3}{10} + \tfrac{3}{100} + \tfrac{3}{1000} \text{ &c.}$$

$$9\,S = 2\tfrac{7}{10} + \tfrac{27}{100} + \tfrac{27}{1000} \text{ &c.}$$

$$d\,S = \tfrac{3}{10} + \tfrac{3}{100} + \tfrac{3}{1000} \text{ &c.}$$

We must, however, excuse this little artifice; since, without deception, it would be vain to attempt to prove that quantity is not quantity.

The non-existence of infinitely small quantities may be satisfactorily proved, *ex absurdo*, as follows:




C A B is a right angled triangle, whereof the base, C A, is greater than the perpendicular A B. If a perpendibular be raised from any part of C A, as at $a$, $a\,b$ : C $a$ :: A B : C A; and if $a$ coincide with the point C, C $a$, and consequently $a\,b$, (which is proportional to C $a$), will vanish; that is they will become equal to o. Now, if a line D E be drawn parallel to A B, and infinitely near to the point C, C $a$ will be infinitely small, and $a\,b$ will be less than the least possible quantity C $a$, which is impossible. Also, D E must either touch the point C, or be separated from it by some space: if it touch the point C, it will pass through it, because C has no parts; and C $a$ will be equal to o. If it does not pass through C, the space which separates C from $a$ will be a perfect quantity, since a certain number of C $a$ = C A. Therefore, there is no infinity, or intermediate term between o, and a finite quantity.

Perhaps the best definition of absolute infinity, is that contained in a sentence

Digitized by Google

inscribed on a dial; it alludes to infinity of duration, or eternity.

"Ex hoc momento pendit Œternitas."

"From this moment, hangs eternity;" or, adapting the sentiments to the superior power of the English language, "Eternity is the morrow of time;" which, in its literal future sense, can never come: here the proper distinction is made between accumulation and infinity; "Hoc momentum," will apply to the remotest period that can be conceived, or to a period indefinitely more remote than can be expressed, taking with it all the infinite series which have been imagined since the creation of the world; still they must ever remain as far from infinity, as time is from eternity. Strictly speaking, we are acquainted with only two sorts of infinity; duration and space; but we may add the *probable* infinity of material bodies. All others have, and can have no existence, except that very equivocal one, in the imagination of speculative philosophers.

The most glorious attribute of mathematical science, is the eternal truth of its doctrines; and sooner or later, the blemish of the false doctrine of infinity will be effaced. But it is too deeply rooted to be easily eradicated; proving men to be in error, is but a small step towards persuading them to abandon it; this error is sanctioned by men of great renown, and their renown is considered a sufficient compensation for the manifest absurdity of the doctrine. Q. E. D.

## SWEEPING CHIMNEYS.

*To the Editor of the* PENNY MECHANIC.

SIR,—With reference to the proposed plan of sweeping chimneys by an endless chain and brush, in No. 56 of the Penny Mechanic, I must inform your correspondent A. M. G., it was tried full sixteen years ago, at a house in Tabernacle Square, Old Street Road, and relinquished on account of the chain being in a short time so much corroded by the soot, and frequently breaking in the operation; which, together with the length and weight, required for lofty chimneys, and the angles to be passed, will, I fear, prove an insurmountable obstacle.

Yours respectfully,

ENTITY.

[We fear our correspondent would make but a poor inventor, to be disheartened by one failure. What would have become of the Thames Tunnel, had Mr. Brunal, (the persevering engineer of that stupendous work) been so easily alarmed at one or two reverses? But in this case we see nothing really objectionable to its adoption. Every thing will wear out in time. We know that smoke-jacks last a long time in chimneys, and why should not an endless chain? As to its corroding, it must have been chiefly in consequence of the indolence of the servant, suffering it to remain a long time without cleaning; this operation would not occupy more than five or ten minutes of her time; and might be performed once or twice a week. The chain being an endless one, every part of it might be easily brought down to the fire-place for that purpose. With respect to the angles, if it cannot be used in a chimney that has seven, it might only be applied to those that have six and under.]

## CAPTAIN BACK.

AT a meeting of the Royal Geographical Society, held Nov. 27, Captain Back gives the following description of his perilous voyage:—From our entrance in the ice to the moment of quitting it, was one continued struggle against enormous floes and heavy masses of ice. The ship was at its mercy, and was frequently thrown into the most perilous situations; but when some convulsion occurred, which was invariably preceded by a furious subaqueous rushing, that produced a loud rolling noise, in an instant, ponderous pieces were upheaved forty feet high, and, at the same time, icy waves a third of a mile in extent, rolled quickly forward, overturning and throwing up slabs and fragments of tons weight, and yet there was little or no water to be seen. These shocks strained the frame of the ship dreadfully—she shook, and trembled so violently, that people fell down on the decks, the timbers cracked, and beams, eighteen inches square, were bent, until the extreme pressure forced the fore part of the keel on the surface, so that one might have crept beneath it; while the stern was half buried between two ridges of ice. It was then that the moving waves, high above our quarter, seemed on the point of overwhelming us—a few feet more, and we must have been crushed to atoms—they even touched the stern,—when, as if arrested by the invisible hand of Providence, the whole turmoil suddenly ceased, and a death-like stillness prevailed.

## BIOGRAPHICAL SKETCHES.

### MR. HERSCHELL.

IT is, perhaps, not generally known, that

Digitized by Google

music was the original profession of that celebrated astronomer, Herschel. "It will appear," says Dr. Miller, "that I was the first person by whose means this extraordinary genius was first drawn from a state of obscurity. About the year 1760, as I was dining with the officers of the Durham militia at Pontefract, one of them informed me, that they had a young German in their band as a performer on the hautboy, who had been only a few months in this country, yet spoke English almost as well as a native; that, exclusive of the hautboy, he was an excellent performer on the violin, and, if I chose to repair to another room, he should entertain me with a solo. I did so, and Mr. Herschel executed a solo of Giardini's, in a manner that surprised me. Afterwards I took an opportunity to have a little conversation with him, and requested to know if he had engaged himself to the Durham militia for any long period? He answered, "No, only from month to month." Leave them, said I, and come and live with me: I am a single man, and think we shall be happy together; doubtless your merit will soon entitle you to a more eligible situation. He consented to my request, and came to Doncaster. It is true, at that time my humble mansion consisted but of two rooms; however, poor as I was, my cottage contained a small library of well-chosen books; and it must appear singular that a young German, who had been so short a time in England, should understand even the peculiarities of our language so well, as to adopt Dean Swift for his favourite author. I took an early opportunity of introducing him at Mr. Copley's concert; and he presently began in

"Untwisting all the chains that tie
The hidden soul of harmony;"

for never before had we heard the concertos of Corelli, Geminiani, and Avison, or the overtures of Handel, performed more chastely, or more according to the original intention of the composers, than by Mr. Herschel. I soon lost my companion—his fame presently spread abroad—he had the offer of scholars, and was solicited to lead the public concerts both at Wakefield and Halifax.

"About this time a new organ for the parish church of Halifax was built by Snetzler, which was opened with an oratorio by the late well-known Joah Bates. Mr. Herschel, and six others, were candidates for the organist's place. They drew lots how they were to perform in rotation. My friend Herschel drew the third lot. The second performer was Mr. Wainwright, afterwards Dr. Wainwright, of Manchester, whose finger was so rapid, that old Snetzler, the organ-builder, ran about the church, exclaiming, 'Te tevel! te tevel! he run over the key like one cat: he will not give my piphes room for to spheak.' During Mr. Wainwright's performance I was standing in the middle aisle with Herschel. What chance have you, said I, to follow this man? He replied, 'I don't know: I am sure fingers won't do.' On which he ascended the organ-loft, and produced from the organ so uncommon a fulness, such a volume of slow sudden harmony, that I could by no means account for the effect. After this short extempore effusion, he finished with the old hundredth psalm-tune, which he played better than his opponent. 'Aye, aye!' cried old Snetzler, 'tish is very goot, very goot indeed: I vil luf tish man, for he gives my piphes room for to spheak.' Having afterwards asked Mr. Herschel by what means, in the beginning of his performance, he produced so uncommon an effect? he replied, 'I told you fingers would not do;' and producing two pieces of lead from his waistcoat pocket, 'One of these,' said he, "I placed on the lowest key of the organ, and the other upon the octave above: thus, by accommodating the harmony, I produced the effect of four hands instead of two. However, as my leading the concert on the violin is their principal object, they will give me the place in preference to a better performer on the organ; but I shall not stay long here, for I have the offer of a superior situation at Bath, which offer I shall accept."

*Exemption of Scientific Institutions from Taxation.*—On the last day of the meeting of the British Association, the chairman announced that he had received a letter from the chairman of a meeting of all the delegates from Literary and Philosophical Institutions, assembled in Liverpool, requesting the general body of the Association to join in a petition to Parliament for the exemption of Buildings used for Literary and Scientific purposes from taxation. Mr. Hutton, M. P. said, he had spoken to the Chancellor of the Exchequer on the subject, and that Government were willing to make the exemption, provided such a strict definition of a Philosophical Institution could be given, as to prevent the possibility of fraudulent claims. There was, however, considerable difficulty on this point.

Digitized by Google

# THE CHEMIST.

## COMBUSTION.

The phenomena of combustion has always been one of much interest to the chemist, although, in consequence of peculiar difficulties that have attended its investigation, so much progress has not been made towards a perfect understanding of it, as of many other processes. These difficulties have arisen principally in consequence of the various theories that have been proposed to explain the phenomenon having contained much truth mingled with much error. The earliest theory supposed fire to be an elementary principle, which had the power of converting combustible bodies into an element similar to itself: and this opinion for a great length of time was almost universally received as true. Subsequently, however, it was discovered that the atmosphere had a considerable influence over combustion; in fact, that substances would only burn for a certain period in a certain quantity of air; and that other substances, saltpetre, for instance, contained a similar principle to that contained in the air, and could support combustion even when the atmosphere was not present. Stahl, the philosopher, afterwards proposed a theory, which, certain assumptions being admitted to be true, appeared capable of explaining the process in a perfectly satisfactory manner. Stahl supposed that all combustible bodies contain a certain principle, which he termed phlogiston, and this assumption being admitted, it is only necessary to suppose that the abstraction of phlogiston is attended with the evolution of light and heat, in order to explain the phenomena that takes place during the combustion of any substance. In old works on chemistry, the phlogistic theory is almost universally adopted, and being simple, it was received for a considerable time by the philosophers as true. Even Priestly, the discoverer of oxygen, the principal supporter of combustion, as we shall presently show, attempted to reconcile the fact, that bodies will not burn if deprived of the atmosphere, by supposing that the air had an affinity for phlogiston, and that its presence was necessary, in order to separate the phlogiston from the combustible. Certain philosophers have supposed that nitrogen is a compound of oxygen with some unknown base; but as this base has never been exhibited in a separate form, the theory received little or no attention from the scientific world. Now, it was in a similar manner that the existence of phlogiston was assumed. It was merely an assumption; the supposed principle had never been exhibited separatad from a combustible; and its existence was, therefore, merely a matter of speculation; yet, as we have stated, in consequence of the apparent simplicity of the theory, it received very great support from the philosophers of the time, and contributed much to retard the progress of the true theory of combustion. Lavosier, the French chemist, perceiving that bodies would not burn when deprived of the atmosphere, was induced to undertake a series of experiments, from which he was led to conclude, that combustion is the consequence of the union of oxygen with a combustible body: and that, unless oxygen were present, neither the ordinary process of combustion, nor the production of flame, could take place. With this theory, it was easy to explain why the atmosphere was necessary for the performance of the process: the atmosphere contains oxygen, and this oxygen it is that unites with the substance that is burnt. Lavosier accordingly examined the air in which a taper had been burnt, and found that it differed materially from the ordinary atmosphere; its oxygen had disappeared: and it would not support flame. Upon analising the air, it was found to consist of carbonic acid and nitrogen; and it was, therefore, evident that the oxygen of the air had combined with the carbonic of the candle, and that the nitrogen had not been changed. With some other modifications, Lavosier's theory is now generally received as correct, but there are still many difficulties to be explained.

Whenever the temperature of any substance is raised beyond a certain point, it becomes luminous. Thus iron, after remaining in the furnace for a certain time, is heated to whiteness, and affords light the same as any common combustible substance when ignited. The effect is in consequence of the powerful chemical action that takes place, between the oxygen of the air and the iron, by which the latter is converted into an oxide. It is well known, that the affinity of any substance for another is increased by the temperature of either of them being raised, and the affinity of the iron for the oxygen, which was not apparent while the iron remained cold, is called into active operation when the iron is heated. That this is the cause of the production of light during the oxidation of the metal may be found by the following experiment:—Let a short earthenware tube be filled with a coil of

Digitized by Google

iron wire, the weight of which has been previously ascertained. Let one extremity of this tube be connected with a bladder filled with oxygen gas, the weight of which is known; and let the other extremity be connected with a flacid bladder, the weight of which, including the air it contains, is also known. Let the tube and its contents be raised to incandescence by the application of heat, and let the oxygen contained in the bladder be then forced through the tube in contact with the wire. The wire in this case will burn, and be rapidly oxidised, and the product will be oxide of iron. When this product is weighed, it will be found to be heavier than iron; and when the two bladders and their contents are weighed, they will be found to be lighter than before, by exactly the weight which the iron has gained; the oxygen, therefore, which has been lost by the air contained in the bladder, has been combined with the iron during the process of combustion. When the vapours of different substances enter into this combination with oxygen, they produce flame, the properties of which we shall describe in another paper.

## ELECTRICITY OF THE WATCH.

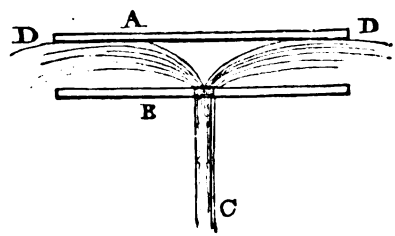
*To the Editor of the Penny Mechanic.*

SIR,—A short time since, having accidentally cracked the glass of my watch, I was not a little surprised, a few days after, when I drew it out hastily, to find that the little particles of dust, which had gained entrance through the crack, were hopping to and fro from the glass to the face, and continued doing so for some seconds. Knowing the cause, I immediately returned it to my fob, and again withdrew it hastily, and presented it to some fragments of thread and paper, which were near, and, as I had predicted, they were in a moment attracted. This is a source of electricity which must be obvious to every one; but I have never seen it noticed in any work on that science. The watch, from being kept warm by the heat of the body, will be always found to act readily, and may in many cases be used as a substitute for wax or glass tube, in some of the minor experiments: and, from this circumstance, I imagined that it might be of some value to those of your readers who, like myself, are fond of this branch of study; and, as it adds another to the many instances of the development of that fluid, which is so materially concerned in the phenomena of the universe, you may, on this account, perhaps, deem it worthy of a place in your small, though useful publication.

I remain, your's, &c.
J. T. Q.

## CURIOUS EXPERIMENT.

THIS is a curious philosophical paradox, and illustrates, in a striking manner, the reason that safety-valves to steam-engine boilers, though constructed on apparently simple principles, do not admit of the egress of the surplus steam when required. C is a glass tube of small bore, at one end of which is the card B, perfectly smooth, and through a hole in the centre of which the tube is inserted (but not otherwise fixed), A is another card of the same shape and size, and also perfectly level and smooth: upon *blowing* outward through the tube, just as a volume of steam would escape from the boiler, a contrary effect is produced to that which would be expected, namely, the upper card A, instead of being blown off, actually adheres closely to the under one, and the stronger the current of air urged through the tube, so the card remains more firmly attached.




The *rationale* of this paradox is this, that the current of air divides itself into two parts, against the upper card, as represented at D D, leaving a vacuum between them, immediately over the orifice of the tube; thus, it will readily be perceived, the pressure of the atmosphere above the card presses it down closely; the card may even be lifted off the table, by simply blowing through the tube. The theory of this practice long puzzled the philosophers of twenty years ago, to whom the experiment was well known, and any one of the readers of this Mazagine may try it for himself, with a short piece of barometer tube. BRACK.

Digitized by Google

*Chlorine.*—Chlorine is a gas of a greenish colour. It may be prepared by mixing muriate of soda (a common sea salt) with three quarters its weight of black oxide of manganese, and introducing them into a retort, or Florence oil flask, and pouring on sulphuric acid, equal to the weight of salt, diluted with its own weight of water; and may be collected over warm water, though in as small a quantity to prevent waste, as that element absorbs twice its bulk of the gas when cold, which is called chlorine water. The *rationale* is simple but striking. Muriate of soda is composed of chlorine, hydrogen, and oxygen, combined to a metallic base called sodium, but which oxygen, having such a powerful affinity for the sodium, in this case it cannot be separate from it, but combines with, and converts it into an oxide, commonly known as soda, and allows the other two gases, chlorine and hydrogen, to quit it, which forms muriatic acid gas. Now, it is evident, if we require chlorine, we must employ some body that will combine with the hydrogen of the muriatic acid, and allow the chlorine to pass off. This being the case, we use manganese, which generates oxygen, and combines with the hydrogen, forming water, and thus allowing the chlorine to escape. The singular property of this gas is, that it does not change vegetable blues as an acid would; but if a vegetable colour is allowed to remain in some chlorine water for a short time, the whole will be colourless. It has also the property of setting the mettles on fire, when introduced into a jar filled with the gas. It combines with oxygen, hydrogen, carbon and nitrogen, which forms a combustible compound.

C. PARKE.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—I shall feel much obliged if any of your Correspondents will, through the medium of your valuable periodical, give me the particulars of the Islington Literary and Scientific Association, in a similar manner to that in which you lately noticed the Milton-street Institution. Yours truly, A. B.

Sir,—I should be glad to know, from any of your scientific Correspondents, where I can purchase the best practical work on Chemistry. J. HILTON.

Sir,—You will much oblige me by giving insertion to the following queries in your valuable little journal:—Which are the best works on the sciences of Mineralogy, Botany, and Entomology; I should prefer those works on the above subjects that treat of classification and the forming of collections, having in my possession a great number of valuable specimens. And having an opportunity of increasing that number to an almost unlimited extent, I think that my leisure hours cannot be more agreeably employed than in this arrangement. J. CROWE.

Sir—"J. L." would render an additional benefit to the public, if he would state, through the medium of your publication, where the inventor of the "apparatus for preventing horses running away," is to be found, or his invention seen. H. H.

Sir,—I should feel greatly indebted if you or any of your Correspondents could acquaint me with the colours or acids used for obtaining a white pattern on a black ground, in calico printing, or refer me to any work on the subject, where I might obtain the required information. B.

Sir,—Can you or any of the numerous readers of your invaluable Magazine explain to me, the best mode of protecting the engraving upon a die while hardening it?

Yours, &c.
An Amateur Die-Sinker.

Sir,—Will any of your Correspondents furnish me with a full and explicit plan for the erection of a Galvanic Battery. One of more power and larger dimensions than the Galvanic Pile described in your last Volume. Or if not within the reach of a mechanic, to where a plain one can be obtained, and at what cost?

A MILTONIAN.

## ANSWERS TO QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—I beg leave to inform your Correspondent in No. 58, that I have two electrical machines to dispose of. One with medical apparatus, packed in a box; the other not packed, and imperfect.

Your's, &c.
JOHN DOBSON.

54, Newington Causeway,

[N.B.—Our Correspondent has favoured us with the price: but the insertion of it would have subjected us to the advertisement duty.]

"J. Hilton."—Shooting stars are supposed by many astronomers to be opaque bodies revolving about the sun, but sometimes approaching very near our earth. A great difference of opinion exists with respect to meteoric stars, some writers asserting that they are projected from volcanic mountains in the moon, and coming within the attraction of our earth, fall on its surface. (See No. 10, Penny Mechanic.)

We know of no better person for restoring the hair, than Mr. Rowland, of Hatton-Garden.

## TO CORRESPONDENTS.

*Our Correspondent "James," must bear in mind that if the flanges of the wheels were made deeper, the rails must stand higher than they do at present, being thus deprived of support, they would oscillate so much, that there would be great danger of their being strained off the sleepers.*

*Received J. Hilton's Fountain; also his Watch Alarm. We have already given our readers the choice of five or six of the latter: if we trouble them with many more, we fear we shall ruffle their tempers, if not alarm them altogether.*

*If the Secretary of the Milton Institution will favour us with a fresh list of Lectures, they will be inserted as usual. Also, any of the other Literary and Scientific Societies in the Metropolis.*

*Received "A Subscriber," "A Real Friend," "S. T." "Y. Z.," &c. &c.*

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LXI.] SATURDAY, DECEMBER 23, 1837. [Vol. II.

### GRINDERS' PROTECTOR.

FIG. 1.

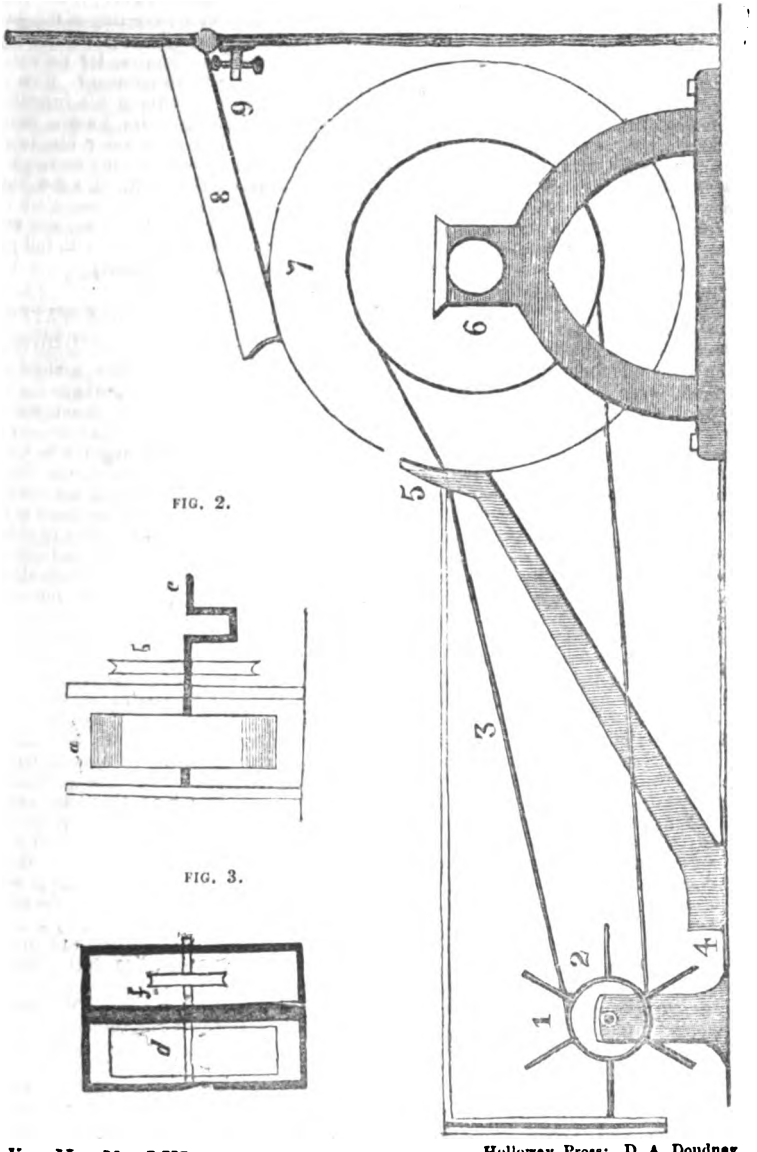



FIG. 2.




FIG. 3.






Holloway Press: D. A. Doudney.

Digitized by Google

## GRINDERS' PROTECTOR.

*To the Editor of the* PENNY MECHANIC.

SIR,—I have taken the liberty to send for your inspection the plan I propose to prevent the bad effect produced on persons employed in the grinding. My plan is simply to place on the same shaft with the stone, a groove-wheel for a band, to connect with another groove wheel, to be smaller, and on the shaft with the small groove-wheel to be a fan-wheel, to force fresh air up to the stone; there being a partition to form a passage the width of the stone and the fan-wheel; the air being conveyed by means of a iron plate made in such manner, that by raising it up it will convey the air up to the most convenient part of the stone. Over the stone is to be a passage to carry off the dust, and a plate to act on a joint, so that as the stone may wear, the clearing-plate may be lowered, care being taken to keep the end of it as near as possible to the stone, without touching, and having the stone enclosed as near as it can to prevent any of the dust passing round with it. The fan wheel may be near the stone, or at the opposite side of the shop; but wherever the entrance may be that is to convey the air for the fan-wheel to act on, it should be carefully selected in such position that the dust from the work may not be drawn in again. Indeed, I consider that the dust should, after passing a convenient distance from the stone, be acted on by a shower of water, and by that means it would be prevented from injuring persons who may live in the neighbourhood. It would be easily managed where there is a supply of water, by having a cistern to supply a trunk, with a plate at the bottom, well perforated with small holes; the cistern being at a suitable elevation. Should there be a high-pressure engine on the premises, the waste steam, after escaping, should be conveyed to operate on the dust. Magnets might be placed to prevent the small particles of steel that may be thrown towards the workman, but that will not prevent the dust being drawn in with the breaking.

I remain yours, &c. T. L. M.

DESCRIPTION—FIG. 1.—1, fan wheel; 2, groove do; 3, band leading from 6; 4, air passage from fan wheel to grindstone; 5, to be a sliding tunnel on the top of the air passage to raise or lower at pleasure; 6, groove wheel on the same shaft as grindstone for the band connecting with the groove wheel on the shaft with fan wheel; 7, grindstone; 8, air passage over stone; 9, a plate to raise or lower, as may be required for the size of the stone, the end of it to be as near as possible, without touching, to convey the dust, off up No. 8.

FIG. 2—a, grindstone; b, groove wheel; c, shaft.

FIG. 3—d, fan wheel; f, groove wheel; o, shaft.

[Our correspondent is far too bashful in the remarks contained in his private letter. Did we not say at the starting of this publication that it should be open to the communications of mechanics, let their style of writing be ever so inferior? With regard to the fear of having his inventions pirated by making them known in our Magazine, we can only refer him to the opinions given by our worthy correspondent Q. E. D. on that subject, a few numbers back. If he should complete the model of his improved engine, and send it to us (or a drawing of it) with full particulars, it shall be inserted.]

## DISTILLATION OF SEA-WATER.

*To the Editor of the* PENNY MECHANIC.

SIR,—As you have before noticed the distillation of sea-water, perhaps the following account may not be uninteresting. It was read before the Royal Society on April 13, 1758, and was written by Capt. W. Chapman, who, on a voyage to Russia in the Sept. previous, fearing his stock of water might not hold out, resolved to the undermentioned ingenious plan to obtain it. The Captain says, "I was not a stranger to Appleby's method; I had also a pamphlet wrote by Dr. Butler, intituled, '*An easy method of procuring fresh water at sea*,' and I imagined that soap might supply the place of capital lees, mentioned by him." The Captain having no still on board, had one constructed in the following manner, which may not be lost on some of your correspondents, who wish to obtain a cheap still. "I now set myself to work, to contrive a still, and ordered an old pitch-pot, that held about ten quarts to be made clean; my carpenter, by my direction, fitted to it a cover of fir deal, about 2 inches thick, very close, so that it was easily made tight by luting it with paste. We had a hole through the cover in which was fixed a pipe nearly perpendicular. This I call the still-head; it was bored with an auger of 1½ inches diameter to within 3 inches of the top or extremity where it was left solid. We made a hole in this, towards the upper part of its cavity (with a proper augle) to receive a long wooden pipe, which we fixed therein, to descend to the tube in which the worm should be placed. Here, again, I was at a loss; for we had no lead pipe, nor any

Digitized by Google

sheet lead on board. I thought, if I could contrive a straight pipe to go through a large cask of cold water, it might answer the end of a worm. We then cut a pewter dish and made a pipe 2 feet long, and at three or four trials, we made it quite tight. We bored a hole through a cask, with a proper descent, in which we fixed the pewter pipe, and making both holes in the cask tight, filled it with sea-water, the pipe stuck without the cask 3 inches on each side. Having now got my apparatus in readiness, I put 7 qts. of sea-water, and 1 oz. of soap, into my pot, and set it on the fire. The cover was kept from rising by a prop of wood at the bow. We fixed on the head, and into it the long wooden pipe above mentioned, which was wide enough to receive the end of the pewter one into its cavity. We easily made the joint tight. (How is not mentioned.)

* * * * *

As soon as the pot boiled, the water began to run, and in 28 minutes, I got a quart of fresh water, I tried it with a hydrometer, and found it as light as river-water, but it had a rank oily taste, which I imagine was given it by the soap. The taste diminished considerably in two or three days, but not so as to make it quite palatable. Our sheep and fowls drank this water greedily, without any ill effects. We constantly kept our still at work, and got a gallon of water every two hours."

The Captain then endeavoured to find out some method by which the water might be rendered more palatable, and read attentively the pamphlet mentioned above, more especially, a quotation from Sir R. Hawkin's voyage, who, "with four billets distilled a hogshead of water, wholesome and nourishing." As the quotation made no mention of the manner in which the billets were to be used, the Captain was puzzled, and at length hit upon the expedient of reducing them to ashes, and putting the ashes into the water. This was no sooner thought of than done, and to use the Captains words, "the result answered my expectations, the water came off bright and transparent, with an agreeable pungent taste, which at first I thought was occasioned by the ashes, but afterwards was convinced it received from the resin or turpentine in the pot or pipes attached to it." The Captain was thus relieved from all apprehension as to a scarcity of water by his own ingenuity and perseverance, and on his arrival at Shields, invited several of his friends to taste the water, and they considered it "nothing inferior" to spring water; and afterwards the Captain treated them to a "capital bowl of punch" made with some of the water.

If a still, the expense of which is a mere trifle, can thus be used to convert sea-water into fresh, no ship should sail without one. Had this been attended to, numbers of our gallant seamen might, perhaps, have been saved from that most dreadful of all deaths—thirst.

I am, &c.

J. F. S.

## GREAT WESTERN RAILWAY.

We hear that the line is completely formed from Paddington to Maidenhead, with the exception of about six miles, which has the ballast on the spot ready for being put on. The culvert which has given way at Paddington is not under the railway, nor does it interfere with it; but under a new road made by the company in lieu of a turnpike road. We understand it was built under the direction, and from a plan laid down by the Court of Sewers. The figure was certainly bad. It consisted of a circle with its lower part cut off. From the excessive pressure of the superincumbent embankment on the extremities of the circle, these probably sunk, and the chord burst up in the middle from the resistance of the sub-soil, which was also accompanied with a similar burst inwards of the sides of the arch. We have inquired at head-quarters, and have been assured that not the least apprehension is entertained of the slip at Hanwell, mentioned in our last, delaying the opening of the railway. The company intended to borrow 800,000*l*., as permitted by Parliament, to complete the works.

### SECOND SECTION.—MAIDENHEAD TO READING. (12¾ MILES.)

The works on this portion of the line, although considerably advanced, are not, of course, in so forward a state as those between London and Maidenhead, as the nature of the earth-work is very different. The Directors, we believe, do not anticipate that this section can be opened so far as Twyford (four miles from Reading) until July next, and to the town of Reading itself in the following autumn. The progress, however, already made, would, we think, justify the expectation of a rather earlier completion of this section of the line.

The bridge over the Thames at Maidenhead, from which we now start, is to be of two arches, and constructed of brick, (of 120 span each.) The abutments are

Digitized by Google

all raised above the water line, the centerings of both arches nearly fixed, and several courses of brick-work laid on the western arch. The land arches on both sides are turned, and the brick-work generally is in a forward state. The plank walls are also carried up to receive the embankment, which already reaches it on the eastern side, and in a few days will be quite finished.

The entire distance between Maidenhead and Reading is divided into contracts of nearly equal length, and a locomotive engine is employed on each of them in forming the embankments.

From the Thames-bridge approaches (which terminate at 22 miles 70 chains from London), an embankment proceeds westwards for upwards of a mile, varying in depth from 35 to 20 feet and less. About two-thirds of this (the furthest from the bridge) is finished, as are two bridges by which it passes over roads to Bray. From this embankment a fine view is obtained of a richly-wooded country, with Windsor Castle towering proudly in the horizon. A finished cutting succeeds, of about half a mile long, in its greatest depth 18 feet, and averaging about 12 feet. The soil is gravel, mixed with sand and flints, and at the westend we get into the chalk, which overlying the gravel, &c., in the embankments hereabout, give them the appearance of long mounds of chalk.

We next come to an embankment of a quarter of a mile, also completed, averaging about 9 feet in depth, and passing by a bridge over the road to Boyne Hill.—This is followed by a cutting of nearly a mile in the chalk, its greatest depth 20 feet, average 11 feet, and crossed by a bridge, carrying a road to Bray.

An embankment succeeds of a quarter of a mile in length, and from 20 to 11 feet in depth, which is also finished, as well as a bridge for another road to Bray, at its western extremity. From this we enter a cutting of about 3 miles in length, in its greatest depth 31 feet, average about 15 feet, through the parishes of Waltham St. Lawrence and White Waltham. About three-quarters of a mile of this cutting is finished, and a long gully is opened through the chalk for half a mile further, the sides being quite perpendicular. After this, for about a mile, the ground is not opened, but the cutting is partially resumed as we approach the western end, where the full depth is reached, and we come out into the open country upon an embankment, averaging 8 feet in depth, and extending about half a mile. It is completed for about two-thirds of its length, nearly up to the Ruscombe Road, which divides the two contracts, and which is to be crossed by a bridge, now in course of erection. Beyond this the embankment is continued for a quarter of a mile, and we then enter a cutting of three-quarters of a mile in length, averaging 25 feet in depth, upon which a considerable force is working from both ends. At its western extremity we cross the road to Twyford (30½ miles from London), the village lying close on the north side of the line. The cutting here, which is in gravel and clay, is crossed by a handsome bridge, of which the piers are finished. A little further on, a fine open view is obtained of the Loddon valley, from the embankment which follows, of upwards of a mile in length, and 20 feet average depth. About a quarter of a mile of this is completed up to the river Slade, being first carried over New Moor Stream by a very neat two-arched bridge, parallel to which, and on either side of it, two roads are carried upon low arches over the same stream. The bridge over the Slade consists of three land arches, and four as a water-way, all of which are nearly completed. It is of red brick, the arches circular, with stone quoins to the piers. A little further on the piers and flank walls are raised for a three-arched bridge, crossing another stream, and we soon after reach the Loddon river, a beautiful fresh stream. This will be crossed by a bridge, having five arches for the water-way, and two land arches, the piers for all being brought up to the spring of the arches. In construction it resembles that over the Slade. From hence the embankment is being formed for about a quarter of a mile, up to the road to Whistley-green, in Sonning parish, which is crossed by a skew bridge of fine dimensions. From this point a finished embankment carries on the line for a quarter of a mile, till we reach the high ground in Sonning, through which it was at first intended to tunnel, but the line will now be carried in deep cutting. This extends in length about one mile and three-quarters, and may average from 30 to 35 feet in depth. At the east-end, about half a mile is under hand, and about the same length at the west-end, where the London road passes over the cutting, a little beyond the thirty-third mile. On leaving this cutting, the view of Reading, Holme Park, and the adjacent country, with the Thames and Kennet rivers flowing through the plain, is very striking, and much interest is excited by the great activity shown in pushing on the works at this spot.

Digitized by Google

From hence the line proceeds towards Reading, upon an embankment of three quarters of a mile in length, and averaging about fourteen feet in depth, which is completed. A short cutting succeeds of about eight chains in length, and varying from one to three feet in depth, passing which we come upon another embankment, carrying the line across the Kennet River and beyond Reading, and being about one mile and a quarter in length to the Caversham-road, where the contract terminates. This embankment is of a nearly uniform depth of about twenty-two feet, and about one-third of it remains to be completed to the Caversham-road.

A temporary bridge is thrown over the Kennet, by which the embankment is carried forward. The abutments for the permanent bridge are raised above the waterline, and the construction of the bridge rapidly advancing. This river is crossed a little south of its junction with the Thames, into which the Kennet falls nearly at right angles.

The crossing of the Caversham-road being about half a mile beyond the point nearest to the town of Reading itself, the station of the Company will probably be fixed in a meadow to the north of Friar-street, whence the best access to the town will be obtained by a direct opening into the centre of that street. This would afford the most convenient thoroughfare, not only for the market-place, but also for all the principal streets, and would not be liable to any interruptions upon the market and fair days, which occasion a very large crowd in all directions about the Forbury and the Market-place.

Between Maidenhead and Reading, the number of bridges passing over or under the railway is thirty, of which nineteen are finished or in course of construction, including seven over rivers and streams. The remaining eleven are all road bridges, and easy of execution. They will all be constructed of red brick, with semi-elliptical arches.—*Railway Magazine.*

## MUTUAL INSTRUCTION SOCIETY,

### No. 16, Great Tower Street.

*Established January* 1836.

The object of this Society is to promote the Moral and Intellectual improvement of its Members by means of Essays, Lectures, Discussions, and Conversations on all subjects.

The Subscription of one Shilling per Quarter constitutes a Member (subject to the approval of a majority of the Members at any Meeting night) and entitles him or her to the use of a Library consisting of Five Hundred Volumes; in addition to which there are Classes formed for the study of the following subjects, viz.

Mechanics and Mathematics, Tuesday evening at 8 o'clock.

| | | | |
|---|---|---|---|
| Botany..... | Tuesday | do. | at ½ past 8 |
| Latin..... | Thursday | do. | at 7 o'clock. |
| Geology.... | Thursday | do. | at 8 do. |
| Writing.... | Thursday | do. | at 8 do. |
| Chymistry.. | Friday | do. | at ½ past 8 |

Persons wishing to become a Member are to apply to Mr. J. Thorne, the Secretary, on any of the evenings of meeting.

Each Member is entitled to introduce a friend on each evening of meeting, which takes place every Monday evening at 8 o'clock; when a Lecture or Essay is delivered, or a Question opened for discussion; and also on Wednesday evenings, when the subject of Monday, if adjourned, is resumed, but when there is no adjourned subject, the Society meet for reading and conversation.

## THE FORMATION OF MOULD.

At the meeting of the Geological Society. Nov. 1, C. D. Darwin, Esq., F.G.S. read a paper "On the Formation of Mould." The author commenced by remarking on the two most striking characters, by which the superficial layer of vegetable mould is distinguished. These are, its nearly homogenous nature, although overlying different kinds of subsoil, and the uniform fineness of its particles. This may be well observed in any gravelly country, where, although in a ploughed field, a large proportion of the soil consists of small stones, yet in old pasture land not a single pebble will be found within some inches of the surface. The author's attention was called to this interesting subject, by Mr. Wedgwood, of Maer Hall, in Staffordshire, who showed him several fields, some of which a few years before had been covered with lime, and others with burnt marl and cinders. These substances in every case were now buried to the depth of some inches beneath the turf, as was ascertained by a careful examination of the several fields; and Mr. Darwin stated, that the appearance in all cases was as if the fragments had, as the farmers believe, worked themselves down. But it did not appear to him at all possible, that either the powdered lime or the fragments of burnt marl and the pebbles, could sink through com-

Digitized by Google

pact earth to some inches beneath the surface. Nor is it probable that the decay of the grass, although adding to the surface of some of the constituent parts of the mould, should separate in so short a time the fine, from the coarse earth, and accumulate the former on those objects, which had so lately been strewed on the surface. Mr. Darwin had also observed near towns, in apparently unploughed fields, pieces of pottery and bones some inches below the surface. So on the mountains of Chili, he had been perplexed by marine elevated shells, covered by earth, in situations where rain could not have washed it on them.

The explanation which occurred to Mr. Wedgwood of these phenomena, Mr. Darwin does not doubt to be the correct one: namely, that the whole is due to the digestive process, by which the common earth-worm is supported. On carefully examining between the blades of grass in the fields where the observations had been made, the author found that there was scarcely a space of two inches square, without a little heap of the cylindrical castings of worms. It is well known, that worms in their excavations swallow earthly matter, and having separated the serviceable portion, eject, at the mouth of their burrows, the remainder in little intestine shaped heaps; hence the fine particles are brought to the surface, and the cinders, burnt marl, or powdered lime, would by degrees be undermined, and eventually become covered by what was previously the underlying earth. In a field on which cinders had been spread only half a year before, Mr. Darwin actually saw the castings of the worms heaped on the smaller fragments.

On the above hypothesis, the great advantage of old pasture land, which farmers are always averse to break up, is explained: for the worms must require a considerable length of time to prepare a thick stratum of mould, by thoroughly mingling the original constituent parts of the soil, as well as the manures added by man. The author observes, that the digestive process of animals is a geological power of greater extent than might at first be imagined. In recent coral formations, the quantity of stone converted into the most impalpable mud, by the excavations of boring shells, and of nerideous animals, must be very great. Numerous large fish (of the genus Sparus) likewise subsist by browsing on the living branches of coral. Mr. Darwin believes, that large portions of the chalk of Europe have been produced from coral, by the digestive action of marine animals, in the same manner as mould has been prepared by the same process on disintegrated rock.

---

*An Enormous Rope.*—We were gratified lately with a sight of a taper flat rope of a pair manufactured by Messrs. Peter Taylor and Co. of Hollinwood, near Manchester, by steam power, in one length without a splicing, and tapering gradually from 8½ to 5½ inches in breadth; each rope we understood to be 300 fathoms in length, or say length of the pair 1200 yards, and weighing together considerably more than nine tons. Although the dimensions and weight of these flat ropes appear so excessive, yet we are assured that round ropes for railways are frequently made at the same manufactory far exceeding these in weight and size, and that if required the proprietors will engage to supply round rope of almost any length whatever without a splicing; of round rope ten or twenty tons would be no object. This is said to be the largest of the description in the annals of rope making. The value of this pair of ropes, according to the rate formerly charged by Mr. Curr, the original patentee, would amount to upwards of 1500*l.*; whereas at the price now charged by Messrs. Peter Taylor and Co., the value is only about one-third of this amount. We believe that until very recently the manufacture of heavy ropes has been principally confined to the neighbourhood of Sunderland and Newcastle-on-Tyne, where they were formerly, and we believe are still occasionally, manufactured for this neighbourhood. In this respect the order of things appears likely to be reversed, the ropes to which we allude manufactured near Manchester being for the celebrated Monkswearmouth colliery, belonging to Messrs. Pemberton, near Sunderland.

*Constitution of the Diamond.*—Sir David Brewster, while pursuing some of his beautiful experiments on light with Diamond lenses, found that the stone was variegated with lines of unequal structure and refraction. These lines appeared to be parallel, and running quite across the side. From this appearance, Sir David has been led to suppose *that the Diamond is a vegetable substance.* It is stated that a coal is vegetable, there is but little doubt the Diamond is also. It is a pure crystal of carbon, and nothing but the process of its crystallization can explain the property above described.

*Ink.*—The best material for diluting ink that has become too thick for use is, a strong decoction of coffee.

Digitized by Google

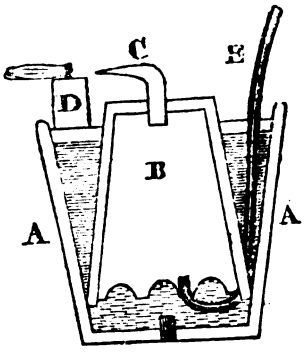
# THE CHEMIST.

## CHEAP BLOW-PIPE.

*To the Editor of the* PENNY MECHANIC.

SIR,—I have sent you a drawing and description of a cheap blow-pipe, which may, perhaps, prove useful to some of your readers:—A A, fig. 1, is a large flower-pot, with an inverted one, B, placed inside

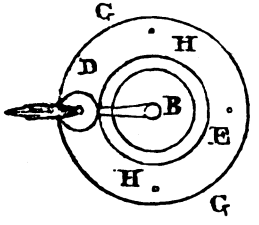
FIG. 1.




of it, which has pieces chipped out at the bottom, to allow the water to pass freely from one into the other; the hole in the bottom of the large flower-pot is stopped up with a cork, to make it water-tight, and the hole in the small one serves to fix the blow-pspe jet opposite the candle or lamp D; E is a piece of pewter-pipe for the operator to blow through.

C C, fig. 2, represents the piece of turned wood to fit in the top, which serves to support the lamp D; to keep the flower-

FIG. 2.




pot B steady, and also to fix the pipe E; the action, it will be seen, is very simple; by blowing through the pipe E, it expels the water which rises in the outer vessel, and, consequently, keeps up a continual pressure through the jet C: H H are two holes made through the board, to allow the air to pass through, as the water rises and falls.

I remain, Sir, your's, &c.

A YOUNG MECHANIC.

## ON THE ELEMENTS.

No 1.

### OXYGEN.

THIS element was discovered by Priestley in 1774, and by Schule in the year following, without previous knowledge of the discovery; it was by them termed vital air, from its properties of supporting life combustion. Oxygen exists in our atmosphere in the proportion of 8 to 28 of nitrogen, and in water 8 to 9 of hydrogen, (its combining proportion being always 8.) It exists in the acids, the alkalies, and is found combined with metals, animal and vegetable substances.

Oxygen does not exist pure in nature; and, therefore, it is obtained by the chemist from some of its compounds—as from the peroxide of manganese, from chlorate of potassci by heat, or from water, by galvanic electricity. For chemical experiments, it is best to obtain it from chlorate of potass, that from manganese not being sufficiently pure, and it being too tedious a process to obtain much by galvanic elrctricity.

The specific gravity of oxygen is 1-111. Water absorbs it very slowly, and in a small quantity, 100 cubic inches of water only absorbing three of the gas. Oxygen is particularly distinguished by its power of supporting combustion, all inflammable substances burning brilliantly in it, and form compounds with it.

APOLLO CHEMICUS.

*Preservation of Vegetables.*—M. d'Faubonne prepared a case in such a manner as entirely to exclude the air; he then mixed potter's clay and cow's dung together, with water enough to render them liquid; with this he covered the stems of some young trees which he wished to convey to the Mauritius, and in which he also steeped the roots; he then covered them with common moss, and filled up all the interstices with straw. He closed the case hermetically; and when it was opened at the end of the voyage, not only were the trees alive, but bearing both leaves and blossoms.

Digitized by Google

*Curious and Simple Electrical Experiments.*—Procure a glass tube, of about 8 inches long, and about half an inch in diameter; rub it briskly in your hand, (which must be warm and dry) then present your knuckle to several parts of the tube one after another, and sparks may be elicited, accompanied with a slight sensation of pain.

Place a glass tumbler on a table, covered with a table-cloth; on the top of the tumbler put a small iron waiter; then take a quarter of a sheet of common writing paper; warm it by the fire, and rub it with India-rubber, rather hard on one side, and then place the other side of the paper flat on the surface of the waiter, and the effect will be the same as in the other experiment. In both experiments, the things mode use of must not be damp, and both must be performed in a dark room.

*Muriatic Acid.*—This gas is prepared in the same manner as chlorine, with the exception of using magnesia. Muriate of soda is introduced into the retort, and sulphuric acic, poured on equal to the weight of salt. Water absorbs this gas rapidly, which is muriatic acid.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—I should be glad if any of your readers would inform me the method of making Invisible Ink?

A SUBSCRIBER.

[Our correspondent must remember in future, that although we shall be willing at any time to insert his queries, it will not be so palatable to us to be compelled to pay the postage of his letters.]

SIR,—Can any of your Correspondents inform me where I can buy a good second-hand magic-lantern, without slides; or, if they have one to dispose of themselves, perhaps they will let me know (per Penny Mechanic) the price, and where to be seen.

Your's, &c. H. C.

SIR,—In No. 48 of your valuable Magazine, a description is given of an electrical machine; I shall feel obliged if any of your readers would inform me, where I can procure the "glass wheel" referred to, and about what the price would be. Also, whether the conductor is to be made in the same manner as for the cylindrical machine; if so, where is it to be placed?

J. P.

SIR,—"J. Evans" cannot be in the habit of having iron-work cast, or he would not talk of 4s. or 5s. for casting an iron bottle from one used for holding ginger-beer. I saw one the other day, the casting of which cost only 7d., intended for the same purpose as that required by a "Young Chymist." One foot of iron tube would do; and although "J. E." is aware of the expansion of iron by heat, he seems to have forgotten its subsequent contraction on becoming cold.

C. D. THOMAS.

SIR,—Having occasion for small pieces of marble, I should feel obliged if any of your correspondents would inform me, through the medium of your useful Magazine, how I can best cut and polish them. Also, how to clean and polish the various kinds of sea-shells.

H. S.

SIR,—I should feel obliged if any of your intelligent readers would inform me of the best method of procuring oxygen gas; also, that of chlorine.

Your's, &c.

C. TAYLOR.

## ANSWERS TO QUERIES.

*To the Editor of the Penny Mechanic.*

To obtain a white pattern on a black ground.—Dip a piece of white calico in a cold solution of sulphate of iron, and suffer it to become entirely dry. Then imprint any figures upon it with a strong solution of colourless nitric acid, and allow this also to dry. If the piece be then well washed in pure warm water, and afterwards boiled in a decoction of logwood, the ground will be dyed either of a slate or black colour, according to the strength of the metallic solution; while the printed figures will remain beautifully white. This experiment shows the effect of acids in discharging vegetable colours.

SIR,—In answer to "a Subscriber," in No. 56 of your highly interesting work, I wish to state, that by the mixture of solution of prussiate of potass and sulphate of iron (copperas), a precipitate of Prussian blue is produced, which, when dried, and mixed with gum water, forms a very good blue ink.

J. C. R. may colour his balloon flame red, by dissolving a little muriate of strontian, in the spirits of wine; he may also colour it green, by a little boracic acid or nitrate of copper.

ELECTRON.

## TO CORRESPONDENTS.

*If we can spare room for* J. F. S.'s *letter on Strikes next week, it shall be inserted; but we do not intend to keep up a long controversy on the subject, as it would become tiring to the general reader.*

W. F. P.'s *opinions on syphons shall be attended to*

*Should any of our correspondents have chemical apparatus, scientific books, &c., to dispose of, and wish to give publicity to the same through our Magazine, they must bear in mind, that, by giving the price, it becomes an advertisement, and we have to pay the duty.*

"C. D. Thomas."—*The article shall appear in a fortnight at farthest. With regard to the suggestion in the latter part of his letter, we beg to inform him that we have very particular reasons for so doing.*

*We have not received the papers on an "Electrical Telegraph," alluded to by "L."*

*Received* Præsque, A Friend, B. S. &c.

*We beg* W. H. White *to accept our thanks for the paper he has sent us. We shall be happy to hear from him again. Also,* A. B. Y. Z.

An Aspiring Mechanic *ought to have written to the inventor for the information he requires. We merely inserted the letter sent us, as a favour, and know nothing of the particulars of the invention.*

A. K.—*We think his plan for a railway protector would be too complicated and expensive to be noticed by any of the companies. Mr. Hawthorn's plan is both simple and effective.*

A Machinist.—*The paper on steam-engine cranks shall appear shortly.*

China *has our best thanks.*

*Received* A. M., G. A. Patterson, *&c.*

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,

## AND THE CHEMIST.

No. LXII.] SATURDAY, DECEMBER 30, 1837. [Vol. II.

RAIL-ROAD ENGINES.—Fig. I.

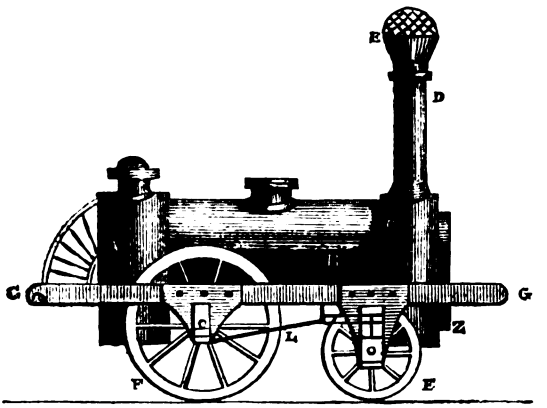



Fig. II.

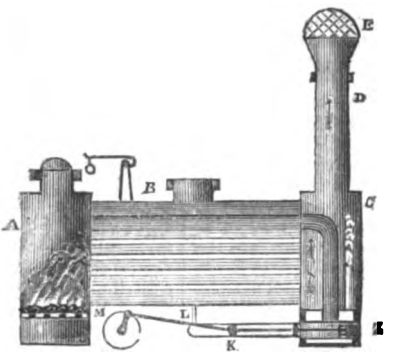
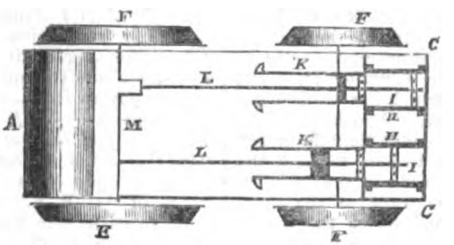



Fig. III.




Vol. II.—No. LXII. Holloway Press: D. A. Doudney

Digitized by Google

## LOCOMOTIVE ENGINES.

*To the Editor of the Penny Mechanic.*

SIR,—Although the exterior form of Rail-road engines is well known no doubt to most of your readers, the interior mechanism is generally but imperfectly understood; I therefore send you the following description of that form now most generally used. Figure 1 represents the interior of the common Rail-road engine. Fig. 2 is a section (longitudinal) of the boiler; and fig. 3 represents an horizontal section of the bottom. The boiler consists of three parts viz., A, fire-box; B, water and steam chamber; and C, smoke-box. The fire-box consists of a double casing of cast iron, in the interior of which the fire is made; the space between the two casings is filled with water, and has two communications with B, the water and steam chamber; one at the bottom, by which it is supplied with water, and the other near the top, by which the heated water and steam pass to the water and steam chamber. the water and steam chamber B is a cylinder of iron, about half an inch thick, through which a number of tubes run; the tubes are from 1 to 3 inches in diameter, and from 40 to 120 in number. The smaller the tubes are, the greater the number. These tubes communicate with both the fire and smoke-boxes, and through them the heated air and gasses pass in their way to the chimney D; so that a large amount of surface is exposed to the action of the fire and heated air. The engines are placed under the boiler. The cylinders are situated in the smoke-box, by which they are maintained at a high temperature. H, H, denote the cylinders. The pistons I I, work in guides K K. L L, represent the crank-rods, and M the cranked axle. The crank is seen in fig. 3, the other, from its position, is not visible. In figs. 1 and 2, that part of the smoke-box in which the cylinders are placed is marked Z. In fig. 2 the fire-box, fire, water, and steam-chamber and smoke-box are seen, as also the air-tubes; the large tube is the one which supplies the engines with steam, and the short upright one in the smoke-box is the eduction pipe, out of which the steam which has worked the engines issues in a jet, and rushing up the chimney creates a vacuum therein, which causes a good draft to pass through the fire; E is a wire gauze cap on the chimney-top, to prevent the escape of the small pieces of burning fuel which the violent draft causes to ascend the flue; G G frame-work of engine.

In some engines the cylinders are placed by the side instead of under the boiler. Some engines have been made with upright cylinders, but as they do not answer so well as horizontal cylinders they are generally discarded. Engines answering the above description cost about 1000*l.* pounds; and if kept at work, cost about 70*l.* per month in repairs; they are from 20 to 50-horse power; burn coke for fuel, which creates very little or no smoke. The barking heard, while an engine is in motion, is occasioned by the escape of the used steam from the chimney described.

Yours, &c. C. D. THOMAS.

## PERPETUAL MOTION.

PERPETUAL motion makers, though often great simpletons, are generally a worthy and deserving class (except those who conceal a moving power for the purpose of deception) and they are rendered still more interesting by the sufferings they endure, through the unfortunate prestige which so subjugates their understanding, that instead of riding their hobbies like other people, they allow their hobbies to ride them, driving them unmercifully through the deserts of imagination, where the admonishing voice of reason, is drowned in the uproar of folly and error.

My present object is to repair the injury which the amiable, but utterly mistaken "G. P. P." has unintentionally inflicted upon those truly unfortunate beings who are "wasting their energy in visionary pursuits, and filling their closets with skeletons of the deformed abortions of their incubus imagination." "G. P. P." says he shall live and die in the belief. But I am happy to say I entertain a more favourable opinion of his case; and I should feel both happy and proud, could I contribute in any way to that conversion which I have no doubt will ultimately be effected by his own good sense. Recollect the words of Casimir Perier. "L'homme absurd est celui qui ne change jamais." And I think I perceive some aptness for conversion in this phrase:—"To make it move it only wants a——a——, you understand me! *that* I wish you to put to it."——I will do so;—it only wants a —— *sufficient knowledge of the nature and laws of motion, to understand that it is impossible.*

Before I proceed to combat the arguments of "G. P. P." I have a little account to settle with him in the name of what he calls the "slow coachmen." As I am myself interested in the vindication of the principles which he thus denounces,

Digitized by Google

I propose, in fairness to both parties, to call in our old friend Phœdrus as umpire. He tells a story of a coachman driving a mule, when an impatient fly ordered the mule to quicken his pace; to whom the mule replied, "I will not be guided by thy voice, Mister fly, but by the gentleman with a whip in the front seat, who knows better than either of us when to stop and when to go;

——"aufer frivolam insolentiam
Namque ubi strigandum est et ubi currendum scio."

I do not mean to call "G. P. P." a fly; if he think so, he may call me the mule, or anything else to balance the account.

The sum of "G. P. P.'s" argument, I understand to be this: modern discoveries have enabled us to accomplish many things which were formerly deemed impossible. Science is constantly bringing forth new wonders, and we have not yet so fully explored the resources of nature as to be able to assign exact limits to its future achievements. He therefore concludes that new combinatiens may, at some future time, produce the perpetual motion which philosophers now affirm to be impossible. This may appear plausible enough to superficial reasoners; but when its defective logic is pointed out, it must share the fate which I hope is reserved for all false doctrine.

Propositions are of three kinds; 1st, things which we know to be true; 2nd, things which we know to be false; 3rd, things upon which we cannot with certainty decide. Now "G. P. P." has only considered the 1st and the 3rd; and as he cannot place his proposition in the 1st division, he transfers it, as a matter of course, to the 3rd; whereas it is amply demonstrated that it belongs to the 2nd. Everyone (except metaphysicians and idiots) must admit that we are acquainted with some facts which we know to be universally and certainly true: thus we know that the whole is greater than a part; that the three angles of a triangle are equal to two right angles; that the earth is a spheroid, and greater than the moon; even ministers of state, upon most occasions so hard to convince, must acknowledge the truth of Milton's proposition, "The mind is its own place;" and we know that if chords be drawn from any points in the circumference of a circle, to an extremity of the diameter which is perpendicular to the horison, the time of a body's descent down each of them will be equal to its perpendicular descent down the diameter.* None but metaphysicians, and the other gentlemen before-mentioned, will deny the truth of the first assertion; and though the last can only be understood by those who have some notion of mechanics, its truth is nevertheless as satisfactorily proved, and equally certain. We also know that a pint measure cannot contain two pints of liquid: that twenty horses cannot be distributed in five stables with an odd number in each stable; and we are equally certain that no motion can be produced, or force exerted, by any means whatever, without a corresponding and equal action in the opposite direction, which is equivalent to saying that no action of the parts of any system of bodies amongst themselves, can increase their whole aggregate quantity of motion; or in other words, motion may be altered, or transferred from one part of a system to another, but it cannot be increased without the action of some external force. If these facts are not equally manifest, the certainty of their truth is equally established; and the orthodoxy of their demonstration is not to be questioned, because Jack and Bob do not understand it. Motion is either the consequence of a force impressed upon a body, or the inherent inertia of matter which inclines a body to continue in any state of motion or quiescence imparted to it. Now inertia is not only an essential property of matter, but is identical with it; inertia is matter, as much as solidity, which in its ultimate analysis can only be designated the force of protrusion. Inertia is invariable in every particle of matter under all circumstances: the different momenta we distinguish in different velocities, are entirely relative, and no action in nature can alter the aggregate momentum, or motion in a given direction, of any system of bodies acting only upon each other; it is as impossible to communicate motion to a body, without taking the same quantity of motion from some other body, as it is to increase the quantity of matter in one body without taking from another.

There are only two sources of mechanical power—gravity and electricity, neither of which produce any effect unless they approximate to a state of equilibrium. The notion of mechanical perpetual motion is not derived from any mistaken opinions respecting the laws of motion; but from the *utter ignorance* of the principles upon which motion depends. By the agency of external forces, perpetual motion may be produced, in a variety of ways. I saw a clock, some time ago, made by one Zamboni, an Italian, which

* This is the key to my solution of the problem of "Boz."

Digitized by Google

is kept in motion by the action of a galvanic pile, upon the extremity of the pendulum. But, what is the use of these things? They must all stop while they are being repaired, and a good spring or a weight would be far preferable. After all, I know of nothing that comes nearer to perpetual motion than a scolding woman's tongue; to make it stop it wants a—a—you understand me? *that* I wish you to put to it.—There's a poser for you, Master P. Q. E. D.

## CYLINDRICAL RAILS.

*To the Editor of the* PENNY MECHANIC.

SIR,—It has often occurred to me that cylindrical rails might be used with more advantage (both as regards cheapness and solidity) than those at present adopted. The rails now in use are supported by iron chairs, which are fixed, by bolts, either on blocks of granite (which cost about 12s. the pair) or on sleepers, prepared after Kyan's process, which are also very expensive. And after all this, it is well known that the rails will oscillate, which is partly owing to the immense weight of the carriages, and partly to the unequal pressure of the flanges against the rails. If two of the T rails were laid on the ground, parallel to each other, without support, and an engine placed on them, and put in motion, it would not proceed far before the rails would be thrown down.—Now if two cylindrical rails (about the same diameter as the pipes used by the gas companies) were laid down in the manner before mentioned, and an engine placed on them, having its wheels sufficiently fluted to cover rather more than one-third of the rails, it would travel along them in safety. The advantages gained by this sort of rail would be,—1st, the saving in the expense of laying them; 2nd, by the wheels being fluted they would tend to keep the rails in their proper position, instead of causing them to oscillate, as the wheels at present in use do; 3rd, the rails, being hollow, might be made to answer the purpose of draining the rail-road. I am aware that objections may be raised against this plan on account of its not being applicable to rail-roads already completed; but I think the curves, and the shifting on to other lines of rails (where the whole of the railway is laid down with cylinders), might be overcome, under the management of some of our clever engineers.

I am yours, &c. H. P.

P.S.—I should feel obliged to "Q.E.D." or any of your scientific correspondents, who would favour me with their opinions of the above plan, through the medium of your valuable Magazine.

## ANSWERS TO THE QUESTIONS IN No. 52.

*An inflexible cylindrical vessel, six inches in height, being filled, contains fifty cubic feet of water; let this vessel be placed with its base to the horizon, and closed in every part except a small hole in the top, into which a common quill is fitted, projecting two inches above the surface of the water. When this quill is filled, how much will the pressure on the bottom of the vessel be increased?*

THE increase of pressure on the bottom of the vessel, produced by the water in the quill, will be 16,666⅔ ounces; or the whole pressure 50,666⅔ ounces, the weight of 50 cubic feet of water being 50,000 oz.

Effects of this kind have obtained the improper appellation of hydrostatical paradox; the effect is exactly what we are led to expect from the principles of hydrostatics, and equally consistent with the general principle of mechanics. It is evident that the whole surface supports the whole incumbent column of water; and when the weight of the water is equal in all parts, every equal portion of the surface will support an equal portion of the pressure. If we suppose the aperture of the tube to be 1-50,000th of the whole surface, the pressure on the corresponding part of the bottom of the vessel will be 1oz.; now, when the tube is filled, the height of the incumbent column resting upon that part of the bottom of the vessel which is immediately under it will be increased from 6 to 8 inches, and the pressure from 1 oz. to 1⅓ oz.; but fluids necessarily press equally upon all parts of a horizontal surface, otherwise there would not be equilibrium amongst the parts of the fluid. A lesser force supporting a greater, which is impossible; therefore, the pressure upon every portion of the surface equal to the aperture of the tube will be increased ⅓; and, consequently, the whole pressure will be increased ⅓, as before stated. If the resistance of the surface of the vessel be considered as the weight, and the water in the tube as the power, W × W's velocity = P × P's velocity, agreeable to the theory of mechanics. Q. E. D.

Digitized by Google

## ON STRIKES.

*To the Editor of the Penny Mechanic.*

Sir,—It is an established maxim, that it is always much more easy to discover an evil than to find a remedy for it; and had I adhered strictly to this rule, I might not have fallen under the censure of your correspondent, A. W. C.

Your correspondent alludes to the remark I made respecting the futility of the workmen striking on the occasion of any dispute, and makes a very lame attempt to convict me of inconsistency. I still hold that opinion, and beg leave to ask A. W. C. to point out what good can possibly arise, either to the masters or workmen, from the latter striking, considering the present relative positions of both. If a workman had nobody but *himself* to provide for, strikes might assume a very different complexion; but it is generally the case that an operative has a wife and family dependent on him: he can, perhaps, for a long time, bear privations himself, but can he bear the cries around him for bread unmoved, when any remedy is within his reach? Certainly not, it would be an insult to human nature to harbour such a thought; and driven by the cries of a starving family, he will, if possible, resume work on almost any terms. Where, in such a case, would be the *utility* of a strike? A strike can only be continued while the money of the operative holds out, and if the masters have more money than the men, it is clear enough who will surrender first. That worst of all rebellions, a rebellion of the belly, is not to be trifled with.

Your correspondent designates the hint I gave respecting *Trade Societies*, as "objectionable:" the plan (as stated in my letter) was mentioned at the last meeting of the British Association. It is not *my* plan, although I should not have the least objection to defend it at another opportunity. A remedy for strikes, come when it may, must be framed with extreme caution, and only after carefully considering the various details of this very intricate subject.

In the last paragraph of his letter, your correspondent says—"But when he asserts that they (the workmen in a strike) resort to gin-shops, I think he must hold the character of the mechanic in low estimation, by the many, for the vices of the few." This I maintain to be at present, unfortunately, the fact to a great extent, although it would be a libel to say that *all* would do so; I never said so, nor had I, I am happy to say, any reason to assert it.

A few words more, and I have done. A. W. C. says, at the close of his remarks, "All strikes that have been made within the last five years have been badly managed, or *they must have succeeded.* Among them were too many masters who manned (qy. marred?) the whole, and thus set aside *that good* that would most certainly have arisen, had they but *listened to the directors!*" I should very much like A. W. C. to prove what he here asserts, and to reconcile it with the first part of his letter, wherein he states he agrees with me, that strikes never can do good to the operatives. I am, Sir, your's, &c. J. F. S.

## METEOROGICAL SOCIETY.

Dec. 12, 1837.

Dr. Lee, F. R. S., F. R. A. S., in the Chair.

At this meeting were read exceedingly interesting papers relative to the *electrical phenomenon* which appeared on the night of Sunday, Nov. 12th ult., from Poole, Worcester, London, Edmonton, Manchester, &c.: but in some of these places were seen a sufficient number of meteors to constitute a *meteoric shower*, which has been so striking a feature in meteorology for several years past on the 12th and 13th of November. It appears, by a paper from Professor Olmsted, Yale College, U. S., that the meteoric shower was seen here in its usual splendour, but no meteors were visible till five minutes before one o'clock, A. M., on the 13th, at which time clouds prevailed at all the places from which accounts had been received by the *Meteorological Society*, which may account for no *meteoric shower* being visible at those places from which notices of the *phenomenon* had been received. Professor Olmsted says the maximum display took place between three and four o'clock in the morning of the 13th ult., and that 226 meteors were visible this year.

Mr. Woods, of 47, Hatton Garden, meteorogical instrument maker to the Society, exhibited diagrams of an instrument which has long been a desideratum among meteorologists,—a self-registering barometer; which, from the simplicity of its construction, and the getting up at no additional expense to the common barometer, there can be little doubt but the instrument will become generally adopted. Mr. Woods also exhibited his improved safety mountain and marine barometers, elegantly fitted up in bronze cases, so that they are calculated to stand high temperatures without being subject to the injury consequent on barometers mounted in wood cases, which invariably split in or about the latitude of 40°., to the injury

Digitized by Google

of ships at sea, and frequently to the great loss of property; and often that which is of much greater consequence, the loss of human life. This gentleman also exhibited his double registering thermometer, and an improved atmospheric thermometer; all of which instruments are constructed upon principles that not only do credit to the inventor, but will secure an accuracy in meteorological registers which has never till this period been arrived at. Engravings and descriptions of all these instruments will be given in the Society's Transactions, which will shortly be published. The meeting then adjourned till Dec. 26.

## MISCELLANIES.

*Royal City Medal.*—Messrs. Griffin and Hyams, of 22, Cornhill, have struck, in honour of her Majesty's late visit to the City of London, a medal of most beautiful workmanship, having a very faithful likeness of our youthful Queen on the front, and the reverse representing her Majesty receiving on the throne the Sword of Justice from the Lord Mayor, with various devices suited to the joyous and memorable occasion. The medal is struck in fine gold, weighing seven ounces, which may be seen gratis: also, from the same die, in silver, price 3*l.* 3*s*, bronze gilt 1*l.* 11*s.* 6*d.*, bronze 15*s.*; and in a particularly pure white metal at 2*s.* 6*d.* each.

*Coloured Lithography.*—The iransaction of the society at Mulhausen announces a new invention by M. M. Engelman, which is coloured lithography; and, as a specimen, gave a landscape encircled by arabesques, highly and elegantly coloured. This is entirely effected in the press; and it is said the process is so simple, as to enable even an inexperienced workman to draw off a hundred proofs in one day. We should be glad if any of our readers could afford us any further information respecting this invention.

*Expedition to the South Pole.*—The French have fitted out an expedition to explore the antartic regions, and proceed, if possible, beyond the limits of Cook and Weddell.

*Gas.*—Does any of our readers know what is the origin or derivation of the word "gas?" The term gas sprang from the same source as ghaist or ghost, both being from a Teutonic word signifying spirit or supernatural being, and variously spelt gast, ghais, or otherwise, according to the different Teutonic dialects. Now, some of the mineral springs of Germany exhale a vapour which hangs above them in the semblance of a light thin cloud. This, being seen, was occasionally taken for a ghais or ghost; but those who had a little more wit at their finger-ends knew the thing to be neither more nor less than a vapour. From this deceptive appearance, however, arose the custom of applying the term ghais to all vapours or æriform bodies; and, being adopted by the continental chemists, the word soon became universal in this sense.—*Greenock Advertiser.*

*Falling Stones.*—An account has been received from Brazil, of the appearance of a meteor of extraordinary brightness, and as large as the balloons used by aeronauts. It was seen for more than sixty leagues in the province of Ceara, and over the village of Macao, at the entrance of the Rio Assu; it burst with a noise like thunder, and an immense quantity of stones fell from it, in a line extending more than ten leagues. The largest portion fell at the entrance of the river, and in various places they pierced through several dwellings, and buried themselves several feet deep in the sand. No human life was lost, but many oxen were killed, and others severly hurt. The weight of those taken out of the sand varied from one to eighty pounds.

*Singular Discovery.*—A singular discovery was made in Blaen-y-nant lead mine, near Mold, Flintshire, a few days ago. The workmen at the end of one of the levels were surprised, and obliged to run for their lives, in consequence of an immense rush of water suddenly bursting in upon them. After three days the water totally disappeared; and, on cautiously proceeding to the place, they found an opening through which the water had issued, of about four inches diameter. Hearing a sound as of a heavy run of water inside, they enlarged the aperture so as to admit of their passing through, and found that it was the bed of a subterraneous river, which in all probability affords the principal supply to the far-famed St. Winifred's Well at Holywell, from which it is distant about twelve miles. The stream being then shallow they explored it about sixty yards down, and were astonished to find several large caverns to the right and left, from the roofs and sides of which were suspended numerous and beautiful specimens of white spar or stalactites. The company are in high spirits, these appearances being considered favourable for a large lodgement of ore.—*Shrewsbury Chronicle.*

Digitized by Google

# THE CHEMIST.

## OIL OF VITRIOL;

Or, liquid sulphuric acid, is colourless, inodorous, and of an oily consistence; it is highly acrid and corrosive; its acid properties are extremely strong, so that a single drop gives to a large quantity of water the power of reddening vegetable blue colours; but when undiluted it has the property of turning vegetable yellow colours, brown, as the alkalies do, but is removed by water. Its boiling point is about 545°. and it solidifies at 15°. below zero.

Sulphuric acid has a great affinity for water. By exposure to the air in an open vessel it imbibes one-third of its weight in 24 hours, and more than six times its weight in a twelvemonth. When one part of water is suddenly mixed with fourtimes its weight of concentrated sulphuric acid, both at the temperature of 50°. it is raised to 300°.; but, according to Dr. Ure, the greatest heat is excited by mixing 73 parts of acid with 27 of water. The mixture of this acid and water always occupies less space than before combination, and the last-mentioned proportions more expecially, for the highest temperature is always succeeded by the greatest condesation. Its specific gravity is about 1·845.

Concentrated sulphuric acid acts very slowly upon the metals at ordinary temperatures; but at a boiling heat many of them decompose it, and are oxidized by combining with a portion of its oxygen while sulphurous acid is given out in the gaseous state. When diluted, it rapidly dissolves those metals which decompose water by its agency, as iron and zinc, with the evolution of hydrogen gas, and it dissolves the oxides of most other metals. It readily combines with the alkalies and earths, and forms with them various important salts.

Most vegetable and animal substances, owing to the carbon they contain, decompose and are decomposed by this acid; this renders it of a dark colour. Although it ought to be colourless, yet the slight colour it often acquires from the circumstance just mentioned, does not materially deteriorate it in quality or reduce its strength.

## AQUA FORTIS,

Or nitric acid, is a dense, colourless fluid; it emits white disagreeable fumes; its taste is extremely sour and acrid, and the skin is indelibly tinged of a yellow colour by it. When exposed to the air, it attracts water, for which it has considerable affinity; and when they are suddenly mixed, heat is evolved.

Nitric acid has usually a yellowish tint, owing to a small quantity of nitrous acid, formed by the partial decomposition of a little of nitric acid during its preparation. By exposure to light and expecially to the direct rays of the sun, it becomes first of straw colour and then of a deep orange, this change is owing to the evolution of oxygen, and the consequent formation of nitrous acid. If concentrated it does not act upon the metals in general, of ordinary temperatures, nor on some of them even when boiled in it: but when a little water is added, most of them decompose a portion of the acid and water also; and the metals combining with the oxygen of both, they are either oxidized and become insoluble, or are dissolved and converted into nitrates, by the nitric acid remaining undecomposed; during this action nitrous gas is given out, which uniting with the oxygen of the air, forms red nitrous acid gas.

It is decomposed by some combustible bodies with great rapidity, as by charcoal, by phosphorus and by sugar; its specific gravity is 1·50.

---

*Potato Brandy.*—M. Krauss, of Dusseldrof, has latley given his attention to the deleterious effects of the spirit extracted from potatoes, and which is in general use in the north of Europe, both as a liquor among the lower classes, and as the basis of a finer class of cordials, and some medicines. Several physicans have already pointed out its deleterous effects, but as the researches of chemists could not find any injurious principle in the rectified spirit, no attention was paid to this opinion. M. Krauss imagines that he has found out the difference between spirit of wine and spirit of potatoes, but he deems it much more important first to show the extraneous matter introduced into the latter, and to this he at present confines himself: he says, that not only is the rectification of the spirit but too often carelessly conducted, but the spirit itself is made from potatoes which are either rotten, or which have begun to germinate. Its effects upon the human frame he describes are most dreadful: producing delirium tremens, idiotcy, &c.; and as, from its cheapness, it is immoderately used, most of the crimes committed in Sweden and Rhenish Prussia, are due to the abuse and nature of this brandy.—*Athenæum.*

---

Digitized by Google

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—If you, or any of your numerous correspondents, could answer the following queries, as early as possible, it will much oblige,

Sir, your obedient servant,
C. PARKE.

1st. What is the cheapest apparatus I can employ, for obtaining the metal potassium?

2nd. In what manner can I analyse a certain compound (starch, for instance) so as to find the constituent parts, and the ratio in which they are combined?

3rd. What wax (if it be) is it, which is used for chemical apparatus, such as the corks of a Woulfe's bottle: *if not wax*, what is it, and how can I make it?

SIR,—I should be glad to know if any of your numerous correspondents can inform me, how I can unite essence of lemon with water, so as not to leave the oily water floating on the surface?

J. WILOUGHBY.

SIR,—You will very much oblige a Constant Reader by inserting the following queries:—

If C. Parke will give me an idea of mixing the colours for paper-staining, I shall thank him. Can any of your readers inform me how the lacquer is put on tin and other goods, to make them appear like brass? Also, what is used to scour woollen cloths, and how is it done? Also, a good cheap olive brown dye. Likewise, how the spirit is made, which is burned in the new lamp, that gives a brilliant light similar to gas? R. G.

Will any of your correspondents inform me of the best, or most suitable work on geology, (not an expensive one) for a person beginning that study?

H. A.

SIR,—I shall feel obliged if any of your correspondents can inform me of any composition that will answer the purpose of oil to machinery, working submerged in sea-water, and will not wash away or rise to the surface, but will adhere to, and preserve machinery exposed to the corroding effects of sea-water?

MACHINIST.

## ANSWERS TO QUERIES.

*To the Editor of the Penny Mechanic.*

*To prepare solar Phosphorus.*—Cleanse oyster shells by well washing; expose them to a red heat for half an hour; separate the purest part, and put it into a crucible in alternate layers with sulphur, till almost full; expose the vessel to a red heat for one hour at least; when cold, break the mass, and separate the whitest parts for use. When enclosed in a bottle, the figure of a watch may be distinguished by its light.

A. B. Y. Z.

*To make Phosphorus*.—If phosphoric acid be mixed with one-fifth of its weight of powdered charcoal, and the mixture distilled at a moderate red heat, in a heated earthen retort, whose beak is partially immersed in a basin of water, drops of a wavy-looking substance will pass over, and, falling into the water, will concrete into a solid, called phosphorus. It can be purified, by straining it through a piece of Chamois leather, under warm water.

The above are answers to "C. Boney," No. 50.

"A Young Mechanic," No. 54.—Immerse the seed for two or three days in oxymuriatic acid, after which sow it in a light soil, and place over it a metallic cover: then bring it in contact with an electric machine, and the plants will be produced in a few minutes. By the same agents as are employed in this process, eggs may be hatched in a few hours; water, in a short period, separated into its two component parts, oxygen and hydrogen, and by the same power restored to its former state; and platina, the most difficult metal to melt, can be fused and *calcined!* by the discharge of an electric battery.

"A. T. R." No. 51.—How magnets are made?—There are several modes in which a piece of iron may be converted into an artificial magnet. The following is a simple and ready method of doing so:—

Let a straight bar of hard tempered steel be held in in a vertical position (or still better, in a position slightly inclined to the perpendicular, the lower end deviating to the earth), and struck several smart blows with a hammer, it will be found by this simple process to have acquired all the properties of the magnet. A. B. Y. Z.

"Inquisitor," No 59—Tracing paper, &c.—I think the following receipt will accomplish what you desire, viz, a good tracing paper:—

Nut oil, oil of turpentine, of each half a pint; rub the paper with the oil, and dry it immediately, by rubbing it with wheat flour; if washed over with ox-gall, it will bear being written upon with ink.

"J. C. A.," No. 57.—For the purpose he requires naptha will be found the best substitute. To make it burn crimson or red a little nitrate of strontia should be dissolved in it; a green flame is produced by using boracic acid; and a yellow by the nitrate of barytes.

"R. H." No. 59.—The best way of joining glass tube, is by using the cement mentioned in the 1st vol. of this work, at the 208th page.

*To an Amateur Die-Sinker.*—The best way of hardening fine steel, as engraved steel, needles, watch-pinions, &c. is to cover them with soap, previous to putting them in a charcoal fire.

SIR,—Presuming that your correspondent, who writes relative to the Cheap Pneumatic Trough, mentioned in a back number, has written the name "Brack" for "C. P.," I beg to inform him, the trough can be made to any size, suiting the purposes and convenience of the operator.

I am, Sir, your obedient Servant,
C. PARKE.

"L. D." Poplar.—Parchment size is generally used; but isinglass is an excellent substitute. Gum Arabic will make a very good varnish. C. S. B.

SIR,—If your corespondent, Tyro, wishes to obtain oxygen gas, he can do it by mixing equal weights of black oxide of manganese and sulphuric acid, in a glass retort, to the heat of an argand lamp, the oxygen will be expelled; by putting the black oxide into a quicksilver bottle, or other vessel equally convenient, and exposing it to a red heat, he will obtain oxygen. If he wishes to obtain large crystals of sulphate of zinc, he must evaporate the solution very slowly, until a slight skin is formed on the surface, and leave it to cool, it will then chrystalize.

CHINA.

ERRATA—No. 60, page 160, "Chloride," line 38, read *many of* "the mettles on fire;" and lines 41 and 42, read "which forms vegetable *compounds.*"

## TO CORRESPONDENTS.

*We see nothing novel in the plan proposed by A. N. D., for preventing steam-engines getting off the rails. In the drawing he has sent us there is nothing more than the common wheels, with the flanches attached to them.*

*We have received* C. D. Thomas's *two papers on the nature and properties of steam, and will endeavour to find room for the first of them shortly.*

*Received* A Subscriber, A. Z., R. S., An Engineer, W. U., H. A., &c.

Apollo Chemicus.—*No.*

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,

## AND THE CHEMIST.

No. LXIII.] SATURDAY, JANUARY 6, 1838. [Vol. II.


## ELECTRICAL EXPERIMENTS.

FIG. I.

FIG. II.

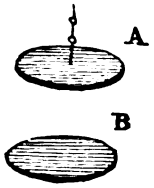



FIG. III.

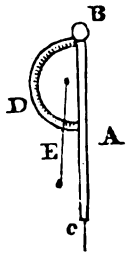



FIG. IV.

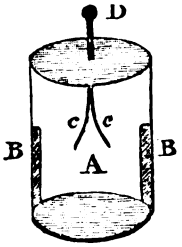



FIG. V.

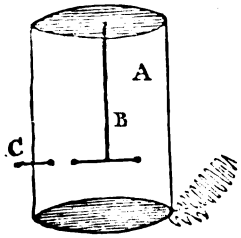



FIG. VI.

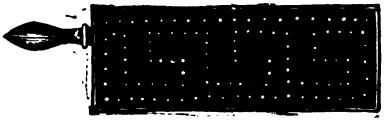


FIG. VII.

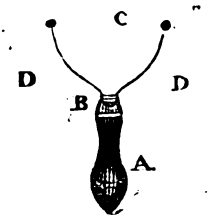
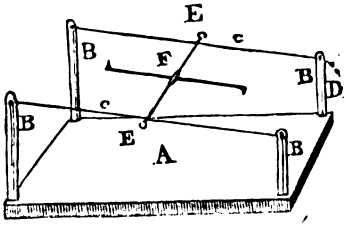



FIG. VIII.







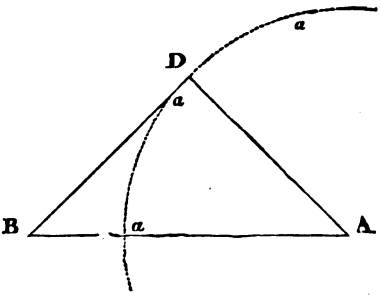
Holloway Press: D. A. Doudney.



Digitized by Google

*To the Editor of the* PENNY MECHANIC.

SIR,—Your Correspondent, "Q. E. D." is in error in the solution of the triangle in No. 58. In that solution the angle D is an obtuse one, and by that the acute angle, B, is diminished; but for increasing it the following diagram will explain:




Draw A B = greatest side, and with A *a*, = lesser side as radius: from the point A describe the dotted circle *a*, *a*, *a*; then, from the point B, draw B D, touching the circle *a*, *a*, *a*, on its circumference; and at right angle to B D draw D A; then B D is the length of the required side, and the greatest possible acute angle is D, B, A.

PRAESEPE.

## ON THE NATURE AND PROPERTIES OF STEAM.

### VIS VAPORIS.

STEAM is now the most powerful and generally-used prime mover of the present age. Steam is water converted into an invisible gas, or vapour, by the agency of heat. Under the ordinary pressure of the atmosphere water assumes the form of steam at 212° of Fahr., and the temperature of the water continues at this point, all additional heat going to form steam, which contains much more heat than boiling water; and the steam produced under these circumstances has an elastic force of about 15 pounds per square inch; viz. it balances the atmosphere pressure. And a cubic inch of water produces cubic foot of steam, or 1728 cubic inc. If, however, the pressure be diminis. or increased, the water will boil at minished or increased temperature. vacuum water boils at 70 every inch of the ba. and 81, causing a degree. And acco. water, when pressed by a column o. cury five inches high, does not l. heated to 217°, each inch of merc. ducing a rise of 1°. The elastic steam thus varying, the determ. its force, at different temper. occupied the attention of m. mental philosophers; viz. Wa. Creighton, Young, Tredg. Dalton, Taylor, M. Dulon. Mr. Tredgold's rule comb. sites of simplicity and acc. results of experiment. T. force of steam in inches barometer, at a given t. thermometer, add 100 perature, and divide raise the quotient to t. it will be the force r. temperature of the in inches mercury 24 atmospheres. to pure water; water the great. made from the water is used, l. used as the div.

## MAGNIFIC

Of the se. gress calcu. the prosp. prospecti. claims t. Junctio. is publi.

The bridg. mont. Ellio. Tyn. Co. cr. pr. t.

— Contracts are ...pletion of the de... by the last session ... which the tunnel at ...avoided. The works have ...d with a degree of activity ...es the inhabitants of that ... country. From Basingstoke ...ster, the entire length is in the ...rmation, and can therefore be ... during the winter to the mutual ... of the labourer and the con... —owing to the former employment ... of the year when work is ... to the latter, a plentiful supply ... —*Railway Magazine.*

Digitized by Google

LUMINOUS CONDUCTORS.

Fig. 6 represents a luminous conductor, a piece of glass plate is the best, but window-glass will do; B a handle by. Place the ball C to your you will see [this should be k] sparks of fire darting marks in a continuous ld be made of round his manner many med.

ing rod. A ed upon hinge at sure; but the handle and bend it two electrical wooden handle. must be taken il on the outside ve the shook. Of at all times.

he working power of den board, into which pillars, B B B B; the two site D are to be shorter at the back of the board; these stretch fine wires, e a chain attached to your lace on the wire a wheel made es of wire, two to be bent round F, F; fix them in piece of wood ther two to terminate in a point be fixed in the piece of wood the ry way to the others; the points to nt, the one up and the other down, een in the engraving: the electricity sses over the chains B, up the wire C, to the wheel, and off at the points, which causes it to turn round and wind itself up the inclined plane. In this way I have drawn small weights up.

ies, two ball i, when icity be ich, will

principle. thread, with a ball of pith re fixed in the be made at each metalic ball; a pin, head at both ends. is placed to the ball will turn one way or purpose the glass jar grees.

## ARSENIC.

It must not be thought that in speaking of arsenic, we refer to that substance in its pure metallic state; no, for it is then almost without any of the injurious effects which, when combined with oxygen, or white oxide of arsenic, makes it worthy of our examination. In this form it is vended by the chemists and druggists for the purpose of destroying the vermin infesting houses; but the persons using it seem to forget the aptitude of these creatures to run over their own eatables, and the ease with which they can transfer by their feet the poison intended for themselves to the stomachs of their enemies. Or again,

Digitized by Google

## METEOROLOGICAL SOCIETY.

### Dec. 12, 1837.

Dr. Birkbeck, F. G. S., President, in the Chair.—After the reading of the minutes of the preceding meeting, and other preliminary business was gone through, the Society proceeded to examine the new Test Instruments made expressly for the Society's use, by Mr. Robert Carr Woods, 47, Hatton Garden* (instrument maker to the Society). The Barometer is a magnificent instrument, the proportion of the cistern to the calibre of the tube being as 50 to 1. a proportion which obviates the correction for capillary attraction.

The Self-registering Barometer is also a beautiful instrument, attached to which is a Six's Thermometer and sunsures, or De Luc's Hygrometer, as purchasers may require.

The Thermometers, Self-registering (day and night), and Double-registering, attracted much attention of the members present; as also did Daniell's Hygrometer. Sir John Ross, R. N., the president, as well as the other members present, expressed their high satisfaction at the close of the examination of the above instruments; and next proceeded to the examination of Mr. Wood's Mountain and Marine Barometer in bronze frames, which also gave great satisfaction to the members (see the report, Dec. 30th, vol. ii. No. lxii.)

The next instrument examined by the Society, was Lieutenant Morrison's, R.N., new Electrometer. This instrument is intended to ascertain the electric state of the atmosphere, that is, whether the electricity in the atmosphere is greater or less than that of the earth; if the former the magnet will deflect to the east, and is termed in meteoric language *plus;* if the latter the magnet will deflect to the west, and is termed *minus.*

The magnet is suspended by a gold thread, from a brass cup fitted to the upper part or apex of a conical glass, which is surmounted by a brass rod about two feet in length terminating in a point. A long discussion took place whether this instrument was properly an electric or an electro-magnetic instrument; the balance of opinion terminated in favour of the latter, in the present form. Sir John Ross suggested an improvement in the suspension of the magnet, which improvement will be made, and the instrument again submitted to the Society for examination. The improvement suggested by Sir John Ross was highly approved by Dr. Birkbeck, and the other members present, upon the conviction that the instrument will be rendered entirely an electrical instrument, and if so, it will be an exceedingly valuable one to the meteorologist.

Several donations of books was then announced by the secretary from the Academie Royale de Bruxelles; the Albany Institute, United States, America; and the South African Institution.

The meeting then adjourned to Tuesday, the 9th of January, when will be exhibited some beautiful diagrams illustrative of meteorological phenomena during a period of fourteen years; and particularly interesting papers read relating to the meteorology of the Volcanic Island of Teneriffe, during a period of eight years: with a description of one of the most interesting tempests known for many years. Friends to meteorology are cordially invited to attend.

* Observers, whether members of the Society or not, may have their instruments attested by the Society's standard, in forwarding them, free of expense, to Mr. Wood. Also all communications for the Society are to be directed to the Secretary, Mr. H. Weiss, 47, Hatton-garden, London, where the laws of the Society may be had gratis.

## MISCELLANIES.

*Timber in a Ship of the Line.*—A regular seventy-four gun ship requires 3,000 oaks to build her; these trees would require 100 acres for their growth, and would be nearly 100 years in coming to maturity—3000 oaks would timber 1,000 cottages for as many industrious families, who would add to the national wealth by their useful pursuits; and this would be a far more profitable way of disposing of oak timber.

*Southampton Railway.*—Contracts are entered into for the completion of the deviation line sanctioned by the last session of Parliament, by which the tunnel at Popham will be avoided. The works have been commenced with a degree of activity which astonishes the inhabitants of that part of the country. From Basingstoke to Winchester, the entire length is in the chalk formation, and can therefore be worked during the winter to the mutual advantage of the labourer and the contractor,—giving to the former employment at a season of the year when work is scarce, and to the latter, a plentiful supply of workmen.—*Railway Magazine.*

Digitized by Google

# THE CHEMIST.

## CHEAP ELECTRICAL EXPERIMENTS.

Let a person stand upon a stool with glass legs (necks of wine bottles), and hold a chain attached to the conductor of the apparatus; sparks of fire may be drawn from any part of his body by a person touching him; care should be taken that the chair, stool, or any part of his body or clothes do not touch the furniture of the room.

Fig 1.—Make a wooden head, the more frightful the better; then get some long hair and fit it on the head; a wire must be placed into the neck, about 4 inches long: then place it in the hole on the top of the conductor, and the hair will stand on end, presenting a most frightful spectacle.

Fig 2.—Get two pieces of round wood, and coat them with tin foil; fix a chair on the top of one (A), which fix to the conductor of your machine; then place the bottom one (B) underneath; previously make some elder pith men; place them between the plates, and they will dance up and down as if alive.

### ELECTROMETERS.

Fig 3.—Electrometers are to indicate the presence and the stength of, electricity. The following is a description of them:—Fig 4 is one of Hewley's. A, a piece of wood terminating in the ball B; the reason of the ball is, because none of the electricty shall fly off a point, as all points should be avoided in your apparatus. At C there is a brass wire to fit it in the hole on the conductor: D an ivory circle marked round the edge to tell the strength of the electricity; E a fine piece of wood, terminating in a pith ball, fixed to a pivot in the centre of the ivory plate.

Fig 4 is one on Bennet's principle, being more tender. A a glass jar; B the sides, coated with tin-foil half way up; C C, two pieces of fine gold leaf attached to the ball C, to which the electricity is applied, when the gold leaf, if the least electricity be present, will separate; and if much, will cling to the tin foil at the sides.

Fig 5 is one on Coulomb's principle. A a glass jar; B a fine silken thread, with a fine piece of wood having a ball of pith on each side; C a fine wire fixed in the jar, for which a hole must be made at each end. There should be a metalic ball; a pin, for instance, with a head at both ends. When the electricity is placed to the ball C, the pith balls will turn one way or another, for which purpose the glass jar is marked into degrees.

### LUMINOUS CONDUCTORS.

Fig. 6 represents a luminous conductor, (A); a piece of glass plate is the best, but common window-glass will do; B a handle to hold it by. Place the ball C to your conductor, and you will see [this should be done in the dark] sparks of fire darting along the dotted marks in a continuous stream; the dots should be made of round pieces of tin-foil; in this manner many pleasing devices can be formed.

Fig. 7 represents a discharging rod. A a glass handle; C two balls placed upon D D, which should be upon a hinge at B, to open or close them at pleasure; but for cheapness, you can make the handle of wood. Get a piece of wire and bend it in the required form; fix on two electrical balls, and put it into the wooden handle. In discharging a jar care must be taken that you touch the tin foil on the outside first, or you will receive the shock. Of course this will not do at all times.

Fig. 8 represents the working power of electricity. A a wooden board, into which are fixed four glass pillars, B B B B; the two which stand opposite D are to be shorter than those placed at the back of the board; from the top of these stretch fine wires, C C; at D have a chain attached to your conductor; place on the wire a wheel made of four pieces of wire, two to be bent round at the ends, F, F; fix them in piece of wood F; the other two to terminate in a point and to be fixed in the piece of wood the contrary way to the others; the points to be bent, the one up and the other down, as seen in the engraving: the electricity passes over the chains B, up the wire C, on to the wheel, and off at the points, which causes it to turn round and wind itself up the inclined plane. In this way I have drawn small weights up.

## ARSENIC.

It must not be thought that in speaking of arsenic, we refer to that substance in its pure metallic state; no, for it is then almost without any of the injurious effects which, when combined with oxygen, or white oxide of arsenic, makes it worthy of our examination. In this form it is vended by the chemists and druggists for the purpose of destroying the vermin infesting houses; but the persons using it seem to forget the aptitude of these creatures to run over their own eatables, and the ease with which they can transfer by their feet the poison intended for themselves to the stomachs of their enemies. Or again,

Digitized by Google

these parties may have purchased more than they can use in the manner just described, the remainder is then put by on a shelf, cupboard, or any other convenient place; and never again, perhaps, thought of, until the servant by mistake accidentally mixes it with the food, and produces those melancholy effects which we daily see in our news journals. It is our intention then, here to give a few of those tests which will enable any individual to discover whether this poison is combined with any substance it is his wish or intention to use.

1st. Let the substance suspected to contain arsenic be dissolved or well soaked in pure rain water (distilled water is better), then add to the solution a little potass, and afterwards a little sulphate of copper, when if it be present a faint green colour will be produced.

2nd. Add one or two drops of ammonia and a little nitrate of silver in solution, when a yellowish cloudy appearance will be perceived in the liquor accompanied with films or streaks of the same colour, descending to the bottom of the vessel containing it.

3rd. Force a stream of sulphuretted hydrogen (made by mixing a little proto-sulphuret of iron in a small retort, with muriatic acid, and applying a gentle heat) into the solution, and a golden cloud will pervade the liquid.

Ammoniaret of copper (formed by adding diluted ammonia to sulphate of copper in solution), will also, when added, produce a yellow colour.

Iodine may also be used as a test.

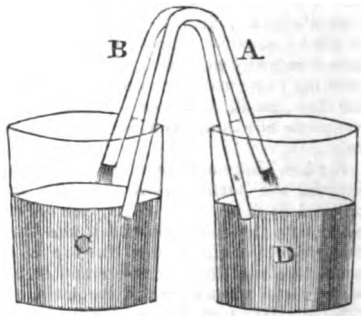
Before concluding this paper, a word may be said with regard to the bad practice of cleansing decanters, wine bottles, &c. with leaden shot; these, as it is generally known, always contain arsenic, and if one or more of this shot be left in a corner of the bottle (as is often the case) it must impart its injurious qualities to the wine, &c., put in that bottle.

W. Burbridge.

## PERPETUAL MOTION.

*To the Editor of the* Penny Mechanic.

Sir,—Although I think that perpetual motion can never be obtained (for it is plain that all materials will, in time, wear out), yet I think motion, as long as the materials last, and with very little friction, can be obtained by the simple contrivance now laid before you. Let two syphons, exactly corresponding in size, be placed so that they shall pour water into two tumblers, or basins, as shown in the drawing, in which A B are the two syphons, and C D are the two tumblers




thus, while the syphon A is pouring water into the tumhler D, the syphon B is pouring water into the tumbler C; and as the syphons are exactly equal, they take out and pour in exactly the same quantity of water, producing motion as long as the materials last. Yours, &c.

W. F. P.

[We are perfectly satisfied that our correspondent has never produced perpetual motion by his plan; but as we have received several similar communications from other subscribers to our Magazine, we have inserted his letter and diagram. Our readers who are unacquainted with the law of hydraulics, must bear in mind that the leg of the syphon from which the water is to flow must be longer than the one in the vessel. The air being then drawn from the conduit, the pressure of the atmosphere on the water inside the vessel will force the fluid up the short leg, and it will descend through the long one by its own gravity.]

## CHLORINE.

Chlorine was discovered in the year 1774 by Scheel, during his researches on the nature of manganese, and called by him *dephlogisticated marine acid*. It was termed by the French chemists *oxygenized muriatic acid*, which was afterwards contracted to *oxy-muriatic acid*, from the supposition that it was a compound of *muriatic acid*, and oxygen. We are indebted to Sir H. Davey for the appellation it now bears; he had the honour of overthrowing the old theory, and substituting in its place that which is commonly called the *new theory of chlorine*. Chlorine gas

Digitized by Google

may be obtained by mixing concentrated hydrochloric acid, in a glass flask, with half its weight of finely-powdered peroxide of manganese. Effervescence, owing to the escape of the gas, takes place, which may be increased by the application of a moderate heat. It should be collected in inverted glass bottles, provided with ground stoppers over water, warm or saturated with common salt, owing to the fact that the gas is absorbed by cold water. Its colour is a yellowish green. It has a very disagreeable smell, with an astringent taste, and is highly injurious when respired, even when considerably diluted with atmospheric air. Dr. Faraday has succeeded in condensing it into the liquid form by subjecting it to a pressure equivalent to about four atmospheres. Cold water absorbs about twice its volume of chlorine, and yields it again when heated. It is a non-conductor of electricity, one of the negative electrics, and a supporter of combustion. If you put a burning taper into a jar of chlorine, it burns with a small red flame for a short time, and emits a large quantity of smoke. Phosphorus takes fire in it spontaneously. Several of the metals, such as tin, copper, antimony, &c. &c. when introduced into chlorine, in the state of powder, are suddenly inflamed. It possesses no acid properties; it does not redden blue flowers when introduced into it. Its strong affinity for the metals is sufficient to prove that it is not an acid: for chemists are not acquainted with any instance of an acid combining directly in definite proportions with a metal. Chlorine is useful for the purposes of fumigation; but one of the most important properties of chlorine is its bleaching powers; but this I shall leave to a future opportunity to discuss. Chlorine may in general be easily known by its colour and odour. It may be detected chemically by its bleaching powers, and by adding a solution of nitrate of silver, which occasions a dense white precipitate (chloride of silver), which becomes black on exposure to light, soluble in ammonia, but insoluble in acids.

JAS. THOMSON, JUN.

*Making Coffee.*—Professor Donovan, in his work lately published on "Domestic Economy", recommends the following plan for making coffee as far preferable to any of those generally adopted. He says infusion in boiling water extracts the aroma without the whole of the bitter; and long boiling extracts all the bitter but dissipates all the aroma; hence we may infer that any effective degree of boiling must be in a slight degree injurious. The right mode of proceeding is therefore obvious; the whole of the water to be used is to be divided into two equal parts; one half is to be placed with the coffee in the coffee pot, and as soon as the liquor comes to a boil, it should be allowed to subside for a few seconds, and then poured off as clear as it will run. Immediately the remaining half of the water at a boiling heat is to be poured on the grounds; the vessel is to be placed on the fire and kept boiling for about three minutes. This will extract all the bitterness left in the grounds; and after a few minutes' subsidence the clear part is to be poured off, and mixed with the former liquor. This mixed liquor now contains all the qualities which originally existed in the roasted coffee in perfection, and it is as hot as any taste could desire it; by some processes it is much cooled, but there is little doubt that the pungent aroma of coffee is perceived by the palate more acutely when the liquor is very hot, and the fact is generally admitted.

*Weight of the Human Body.*—M. Chaussier dried a human body in an oven, the original weight of which was 120 pounds: when dry it was reduced to 12 pounds. Hence the solid matter of the body was water as 9 to 1, or one tenth. From this it will be seen how great a proportion the fluids of the body bear to the solids.

*An Earthquake in Rutland.*—On Friday night last, about 11 o'clock, the shock of an earthquake was felt throughout the vale of Catmos. There were three trepidations, in succession, and so violent as to shake substantial stone houses to their bases. Some rushed out of their houses, imagining it was an explosion of gunpowder in some neighbouring conflagration. A similar convulsion, but not so powerful, occurred also three weeks ago. The shock was, about the same time, felt in Stamford and the neighbouring villages. —*Lincolnshire Chronicle.*

*Vegetable Physiology.*—M. Mirbel has been making some observations on the cambium of vegetables, in which he confirms the opinion of Grew and Duhamel, that all vegetable tissue has been cambium at first, or mucilaginous matter, of extreme delicacy, which he, in other terms, names cellular mucilage.

Mr. Hartley has discovered that brass protects both wrought and cast iron from the action of salt water; and, contrary to all previous experiments on electro-chemistry, he states that the brass itself remains unaffected.

Digitized by Google

## INSTITUTIONS.

*Mutual Instruction Society, 16, Great Tower-street.*—The first Lecture for 1838 was delivered on Jan. 1, by Mr. Davenport—Question—Which is the best mode of Improving the Condition of Mankind?

Jan. 8, Mr. Carstairs on Beumanship—Second Lecture.

The second Anniversary Supper of the above Institution will take place on Jan. 9, 1838, at Short's Strand Hotel.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Can you or any of your Correspondents inform me what liquid is used to turn albata white?

INQUISITOR.

SIR,—You will oblige me by inserting the following queries in your periodical:—1. How to take the bottom out of a phial or bottle.—2. Where to buy the large black lead pots to make Aikin's furnace.—3. How to make a composition to line a large Mongelfier balloon, to prevent it firing.

SIR,—I should be glad to be informed, through the medium of your valuable and interesting publication, the principal on which the vane acts, which is at Lloyd's coffee-room, Royal Exchange, so as to indicate the state of the wind on a dial, which is fixed within the room.

SIR,—Can any of your Correspondents inform me of some amusing experiments with phosphorus; also the way in which different colours on cloth are dyed; and also, the most approved method of quick-silvering looking-glasses? C. C. W.

SIR,—Will any of your Correspondents have the goodness to inform me of the most simple way of constructing an electro-magnetic apparatus, and why sulphate of copper is used? H. A.

SIR,—Can any of your intelligent Correspondents inform me of any public museum where I can gain information on geology, or where I can see the crust of the earth stratigraphically arranged? I am sorry to say the British Museum does not contain anything of the kind. H. A.

## ANSWERS TO QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Your Correspondent, C. D. Thomas, informs me, that with regard to the iron tube to the gas bottle (No 61), I had forgotten the subsequent contraction of the iron on its becoming cold. If he would take the trouble to make the experiment, he would find himself entirely mistaken; for whatever the subsequent contraction of the iron might be, it is not near equal to the prior expansion caused by the heat. He also states that the iron bottle would cost but 7*d.*; but whether he be correct or not, I will leave more experienced judges than he appears to be to decide.

J. EVANS.

If "Goddard" is in possession of our back numbers, he will find several receipts for joining the gores of paper balloons.

"A Subscriber," No. 61. If you stamp sal-ammoniac, and mix it with water, it makes white ink, which cannot be read till held to fire, which makes it black.

"H. O." No. 61. There is a very good and large magic lantern, without slides, for sale, at a miscellaneous repository in the New-cut, six doors from the Victoria Theatre. T. B.

"H. P." is informed, that cylindrical rails have been invented, and also patented, I believe, some time; but why they are not used, I know not. They are, in my opinion, superior to those in general use; and I have never seen any objections to them. They would weigh less if used semi-cylindrical; and by having a flange, could be easily fastened to the bearers. C. D. T.

*Illustration of the Art of Calico Printing.*—1st. *To produce a White Pattern on a Black Ground.*—Let a piece of white calico be dipped in a cold solution of sulphate of iron and dried; then imprint the figures upon it with a strong solution of colourless citric acid, and let this dry also. If the piece be then well washed in warm water, and afterwards boiled in a decoction of logwood, the ground will be dried either a slate or black colour, according to the strength of the metallic solution, while printed figures will remain beautifully white.

2nd. *To produce a Scarlet Pattern on a Black Ground.*—Dip a piece of white calico in a strong solution of acetate of iron (which may be made by boiling sulphate of iron with acetate of lead), dry it by the fire, and lay it aside for three or four days. After this, wash it well in hot water, and then dye it black, by boiling it for ten minutes in a strong decoction of logwood: and, lastly, rince it in water, and let it dry. Now any figures printed upon it with a colourless solution of muriate of tin, will acquire a beautiful scarlet colour, though the ground remain black. I hope your Correspondent "B" will find the above to succeed. I believe them to be the ones in general use, but as I have not tried them, cannot speak from experience.

J. R. W.

SIR,—I beg to inform "Charlemagne," I have an electrical machine to dispose of, with several apparatus. Apply to C. B., 70, Chapel-street, Pentonville.

SIR,—"J. Hilton" should peruse "Griffin's Chemical Recreations," Tegg, Cheapside, as the best practical work on the subject.

Your Correspondent "C. Boney," who inquires how to make phosphorus, is informed that he can procure it at Dymond's, 146, Holborn-bars, at the rate of 2*s.* 6*d.* per ounce. The process for obtaining it is not only dangerous but troublesome in the extreme. Oyster shells do not contain any appreciable quantity, and phosphorus is never obtained from them; it is procured from hones calcined, mixed with charcoal, and distilled from an earthen retort into water; it is purified by straining through leather immersed in hot water.

I would recommend to "H. Kigdon," who wishes to know the best work on the arts and sciences, to Partington's British Cyclopædia, two volumes, in monthly parts, price 1*s.* each. CHINA.

## TO CORRESPONDENTS.

G. L. M.—*We have so many plans for parachutes and balloons before us, that we scarcely know which to choose. Our Magazine will shortly contain an engraving and description of one on a new principle.*

*The plan for an electrical telegraph sent us by* L. *shall appear in a fortnight*

*We thank* J. R. Watts *for the papers he has sent us.*

C. T. *need not be afraid of the working classes being deprived of employment by the establishment of a Polytechnic School on Mr. Hawkins's plan; for, according to his own letter, the rich will never send their sons to labour for their bread; and the poor will not have it in their power; therefore the institution will only exist in name.*

Tyro Locke's *paper on measuring timber will, no doubt, be useful to many of our readers.*

John Miles's *plan for propelling boats, is nothing more than the Archimedes screw; the properties of which are well known to all scientific men.*

*Received*—G. A. Patterson—T. L. M.

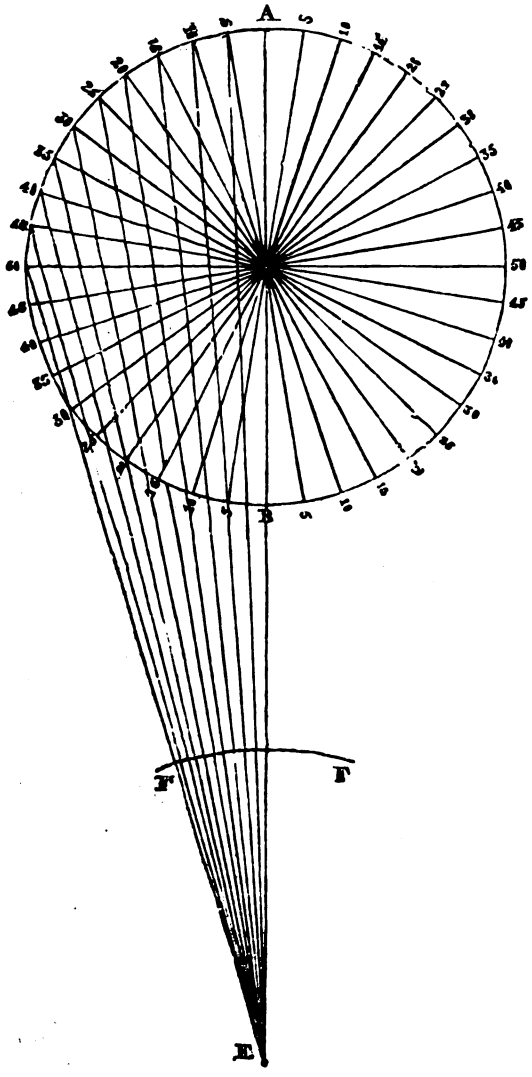
London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LXIV.] SATURDAY, JANUARY 13, 1838. [Vol. II.

### MATHEW'S METHOD OF CALCULATING STEAM POWER.






Holloway Press: D. A. Doudney

Digitized by Google

*Curious and Simple Electrical Experiments.*—Procure a glass tube, of about 8 inches long, and about half an inch in diameter; rub it briskly in your hand, (which must be warm and dry) then present your knuckle to several parts of the tube one after another, and sparks may be elicited, accompanied with a slight sensation of pain.

Place a glass tumbler on a table, covered with a table-cloth; on the top of the tumbler put a small iron waiter; then take a quarter of a sheet of common writing paper; warm it by the fire, and rub it with India-rubber, rather hard on one side, and then place the other side of the paper flat on the surface of the waiter, and the effect will be the same as in the other experiment. In both experiments, the things mode use of must not be damp, and both must be performed in a dark room.

*Muriatic Acid.*—This gas is prepared in the same manner as chloriue, with the exception of using magnesia. Muriate of soda is introduced into the retort, and sulphuric acic, poured on equal to the weight of salt. Water absorbs this gas rapidly, which is muriatic acid.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—I should be glad if any of your readers would inform me the method of making Invisible Ink?

A Subscriber.

[Our correspondent must remember in future, that although we shall be willing at any time to insert his queries, it will not be so palatable to us to be compelled to pay the postage of his letters.]

Sir,—Can any of your Correspondents inform me where I can buy a good second-hand magic-lantern, without slides; or, if they have one to dispose of themselves, perhaps they will let me know (per Penny Mechanic) the price, and where to be seen.

Your's, &c. H. C.

Sir,—In No. 48 of your valuable Magazine, a description is given of an electrical machine; I shall feel obliged if any of your readers would inform me, where I can procure the "glass wheel" referred to, and about what the price would be. Also, whether the conductor is to be made in the same manner as for the cylindrical machine; if so, where is it to be placed? J. P.

Sir,—"J. Evans" cannot be in the habit of having Iron-work cast, or he would not talk of 4s. or 5s. for casting an iron bottle from one used for holding ginger-beer. I saw one the other day, the casting of which cost only 7d., intended for the same purpose as that required by a "Young Chymist." One foot of iron tube would do; and although "J. E." is aware of the expansion of iron by heat, he seems to have forgotten its subsequent contraction on becoming cold. C. D. Thomas.

Sir,—Having occasion for small pieces of marble, I should feel obliged if any of your correspondents would inform me, through the medium of your useful Magazine, how I can best cut and polish them. Also, how to clean and polish the various kinds of sea-shells. H. S.

Sir,—I should feel obliged if any of your intelligent readers would inform me of the best method of procuring oxygen gas; also, that of chlorine.

Your's, &c.

C. Taylor.

## ANSWERS TO QUERIES.

*To the Editor of the Penny Mechanic.*

To obtain a white pattern on a black ground.—Dip a piece of white calico in a cold solution of sulphate of iron, and suffer it to become entirely dry. Then imprint any figures upon it with a strong solution of colourless nitric acid, and allow this also to dry. If the piece be then well washed in pure warm water, and afterwards boiled in a decoction of logwood, the ground will be dyed either of a slate or black colour, according to the strength of the metallic solution; while the printed figures will remain beautifully white. This experiment shows the effect of acids in discharging vegetable colours.

Sir,—In answer to "a Subscriber," in No. 56 of your highly interesting work, I wish to state, that by the mixture of solution of prussiate of potass and sulphate of iron (copperas), a precipitate of Prussian blue is produced, which, when dried, and mixed with gum water, forms a very good blue ink.

J. C. R. may colour his balloon flame red, by dissolving a little muriate of strontian, in the spirits of wine; he may also colour it green, by a little boracic acid or nitrate of copper.

Electron.

## TO CORRESPONDENTS.

*If we can spare room for* J. F. S.'s *letter on Strikes next week, it shall be inserted; but we do not intend to keep up a long controversy on the subject, as it would become tiring to the general reader.*

W. F. P.'s *opinions on syphons shall be attended to*

*Should any of our correspondents have chemical apparatus, scientific books, &c., to dispose of, and wish to give publicity to the same through our Magazine, they must bear in mind, that, by giving the price, it becomes an advertisement, and we have to pay the duty.*

"C. D. Thomas."—*The article shall appear in a fortnight at farthest. With regard to the suggestion in the latter part of his letter, we beg to inform him that we have very particular reasons for so doing.*

*We have not received the papers on an "Electrical Telegraph," alluded to by "L."*

*Received* Præsque, A Friend, B. S. &c.

*We beg* W. H. White *to accept our thanks for the paper he has sent us. We shall be happy to hear from him again.* Also, A. B. Y. Z.

An Aspiring Mechanic *ought to have written to the inventor for the information he requires. We merely inserted the letter sent us, as a favour, and know nothing of the particulars of the invention.*

A. K.—*We think his plan for a railway protector would be too complicated and expensive to be noticed by any of the companies. Mr. Hawthorn's plan is both simple and effective.*

A Machinist.—*The paper on steam-engine cranks shall appear shortly.*

China *has our best thanks.*

*Received* A. M., G. A. Patterson, &c.

London: Printed at the Holloway Press, by D. A. Doudney; where all Communications are to be addressed (post paid); published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,

## AND THE CHEMIST.

No. LXII.] SATURDAY, DECEMBER 30, 1837. [Vol. II.

RAIL-ROAD ENGINES.—Fig. I.

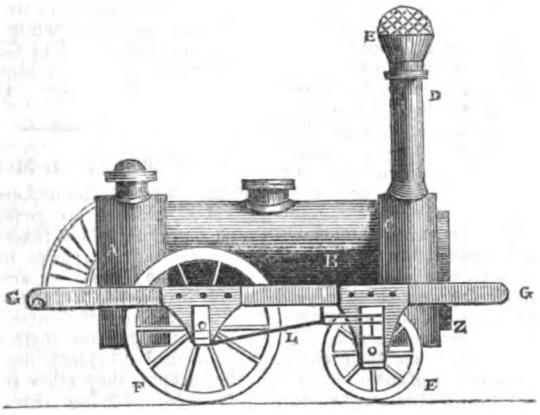



FIG. II.

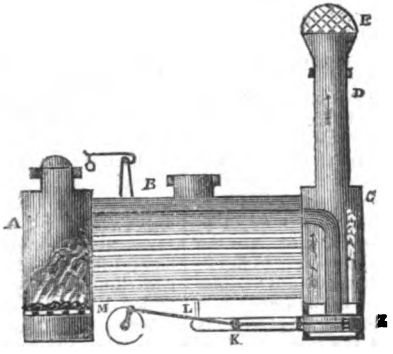
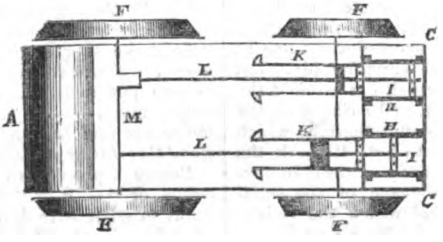



FIG. III.




Vol. II.—No. LXII. Holloway Press: D. A. Doudney

Digitized by Google

## LOCOMOTIVE ENGINES.

*To the Editor of the Penny Mechanic.*

SIR,—Although the exterior form of Rail-road engines is well known no doubt to most of your readers, the interior mechanism is generally but imperfectly understood; I therefore send you the following description of that form now most generally used. Figure 1 represents the interior of the common Rail-road engine. Fig. 2 is a section (longitudinal) of the boiler; and fig. 3 represents an horizontal section of the bottom. The boiler consists of three parts viz., A, fire-box; B, water and steam chamber; and C, smoke-box. The fire-box consists of a double casing of cast iron, in the interior of which the fire is made; the space between the two casings is filled with water, and has two communications with B, the water and steam chamber; one at the bottom, by which it is supplied with water, and the other near the top, by which the heated water and steam pass to the water and steam chamber. the water and steam chamber B is a cylinder of iron, about half an inch thick, through which a number of tubes run; the tubes are from 1 to 3 inches in diameter, and from 40 to 120 in number. The smaller the tubes are, the greater the number. These tubes communicate with both the fire and smoke-boxes, and through them the heated air and gasses pass in their way to the chimney D; so that a large amount of surface is exposed to the action of the fire and heated air. The engines are placed under the boiler. The cylinders are situated in the smoke-box, by which they are maintained at a high temperature. H, H, denote the cylinders. The pistons I I, work in guides K K. L L, represent the crank-rods, and M the cranked axle. The crank is seen in fig. 3, the other, from its position, is not visible. In figs. 1 and 2, that part of the smoke-box in which the cylinders are placed is marked Z. In fig. 2 the fire-box, fire, water, and steam-chamber and smoke-box are seen, as also the air-tubes; the large tube is the one which supplies the engines with steam, and the short upright one in the smoke-box is the eduction pipe, out of which the steam which has worked the engines issues in a jet, and rushing up the chimney creates a vacuum therein, which causes a good draft to pass through the fire; E is a wire gauze cap on the chimney-top, to prevent the escape of the small pieces of burning fuel which the violent draft causes to ascend the flue; G G frame-work of engine.

In some engines the cylinders are placed by the side instead of under the boiler. Some engines have been made with upright cylinders, but as they do not answer so well as horizontal cylinders they are generally discarded. Engines answering the above description cost about 1000*l.* pounds; and if kept at work, cost about 70*l.* per month in repairs; they are from 20 to 50-horse power; burn coke for fuel, which creates very little or no smoke. The barking heard, while an engine is in motion, is occasioned by the escape of the used steam from the chimney described.

Yours, &c. C. D. THOMAS.

## PERPETUAL MOTION.

PERPETUAL motion makers, though often great simpletons, are generally a worthy and deserving class (except those who conceal a moving power for the purpose of deception) and they are rendered still more interesting by the sufferings they endure, through the unfortunate prestige which so subjugates their understanding, that instead of riding their hobbies like other people, they allow their hobbies to ride them, driving them unmercifully through the deserts of imagination, where the admonishing voice of reason, is drowned in the uproar of folly and error.

My present object is to repair the injury which the amiable, but utterly mistaken "G. P. P." has unintentionally inflicted upon those truly unfortunate beings who are "wasting their energy in visionary pursuits, and filling their closets with skeletons of the deformed abortions of their incubus imagination." "G. P. P." says he shall live and die in the belief. But I am happy to say I entertain a more favourable opinion of his case; and I should feel both happy and proud, could I contribute in any way to that conversion which I have no doubt will ultimately be effected by his own good sense. Recollect the words of Casimir Perier. "L'homme absurd est celui qui ne change jamais." And I think I perceive some aptness for conversion in this phrase:—"To make it move it only wants a——a——, you understand me! *that* I wish you to put to it."——I will do so;—it only wants a —— *sufficient knowledge of the nature and laws of motion, to understand that it is impossible.*

Before I proceed to combat the arguments of "G. P. P." I have a little account to settle with him in the name of what he calls the "slow coachmen." As I am myself interested in the vindication of the principles which he thus denounces,

Digitized by Google

I propose, in fairness to both parties, to call in our old friend Phœdrus as umpire. He tells a story of a coachman driving a mule, when an impatient fly ordered the mule to quicken his pace; to whom the mule replied, "I will not be guided by thy voice, Mister fly, but by the gentleman with a whip in the front seat, who knows better than either of us when to stop and when to go;

——"aufer frivolam insolentiam
Namque ubi strigandum est et ubi currendum scio."

I do not mean to call "G. P. P." a fly; if he think so, he may call me the mule, or anything else to balance the account.

The sum of "G. P. P.'s" argument, I understand to be this: modern discoveries have enabled us to accomplish many things which were formerly deemed impossible. Science is constantly bringing forth new wonders, and we have not yet so fully explored the resources of nature as to be able to assign exact limits to its future achievements. He therefore concludes that new combinatiens may, at some future time, produce the perpetual motion which philosophers now affirm to be impossible. This may appear plausible enough to superficial reasoners; but when its defective logic is pointed out, it must share the fate which I hope is reserved for all false doctrine.

Propositions are of three kinds; 1st, things which we know to be true; 2nd, things which we know to be false; 3rd, things upon which we cannot with certainty decide. Now "G. P. P." has only considered the 1st and the 3rd; and as he cannot place his proposition in the 1st division, he transfers it, as a matter of course, to the 3rd; whereas it is amply demonstrated that it belongs to the 2nd. Everyone (except metaphysicians and idiots) must admit that we are acquainted with some facts which we know to be universally and certainly true: thus we know that the whole is greater than a part; that the three angles of a triangle are equal to two right angles; that the earth is a spheroid, and greater than the moon; even ministers of state, upon most occasions so hard to convince, must acknowledge the truth of Milton's proposition, "The mind is its own place;" and we know that if chords be drawn from any points in the circumference of a circle, to an extremity of the diameter which is perpendicular to the horison, the time of a body's descent down each of them will be equal to its perpendicular descent down the diameter.* None but metaphysicians, and the other gentlemen before-mentioned, will deny the truth of the first assertion; and though the last can only be understood by those who have some notion of mechanics, its truth is nevertheless as satisfactorily proved, and equally certain. We also know that a pint measure cannot contain two pints of liquid: that twenty horses cannot be distributed in five stables with an odd number in each stable; and we are equally certain that no motion can be produced, or force exerted, by any means whatever, without a corresponding and equal action in the opposite direction, which is equivalent to saying that no action of the parts of any system of bodies amongst themselves, can increase their whole aggregate quantity of motion; or in other words, motion may be altered, or transferred from one part of a system to another, but it cannot be increased without the action of some external force. If these facts are not equally manifest, the certainty of their truth is equally established; and the orthodoxy of their demonstration is not to be questioned, because Jack and Bob do not understand it. Motion is either the consequence of a force impressed upon a body, or the inherent inertia of matter which inclines a body to continue in any state of motion or quiescence imparted to it. Now inertia is not only an essential property of matter, but is identical with it; inertia is matter, as much as solidity, which in its ultimate analysis can only be designated the force of protrusion. Inertia is invariable in every particle of matter under all circumstances: the different momenta we distinguish in different velocities, are entirely relative, and no action in nature can alter the aggregate momentum, or motion in a given direction, of any system of bodies acting only upon each other; it is as impossible to communicate motion to a body, without taking the same quantity of motion from some other body, as it is to increase the quantity of matter in one body without taking from another.

There are only two sources of mechanical power—gravity and electricity, neither of which produce any effect unless they approximate to a state of equilibrium. The notion of mechanical perpetual motion is not derived from any mistaken opinions respecting the laws of motion; but from the *utter ignorance* of the principles upon which motion depends. By the agency of external forces, perpetual motion may be produced, in a variety of ways. I saw a clock, some time ago, made by one Zamboni, an Italier., which

* This is the key to my solution of the problem of "Boz."

Digitized by Google

is kept in motion by the action of a galvanic pile, upon the extremity of the pendulum. But, what is the use of these things? They must all stop while they are being repaired, and a good spring or a weight would be far preferable. After all, I know of nothing that comes nearer to perpetual motion than a scolding woman's tongue; to make it stop it wants a—a—you understand me? *that* I wish you to put to it.—There's a poser for you, Master P. Q. E. D.

## CYLINDRICAL RAILS.

*To the Editor of the* PENNY MECHANIC.

SIR,—It has often occurred to me that cylindrical rails might be used with more advantage (both as regards cheapness and solidity) than those at present adopted. The rails now in use are supported by iron chairs, which are fixed, by bolts, either on blocks of granite (which cost about 12s. the pair) or on sleepers, prepared after Kyan's process, which are also very expensive. And after all this, it is well known that the rails will oscillate, which is partly owing to the immense weight of the carriages, and partly to the unequal pressure of the flanges against the rails. If two of the T rails were laid on the ground, parallel to each other, without support, and an engine placed on them, and put in motion, it would not proceed far before the rails would be thrown down.—Now if two cylindrical rails (about the same diameter as the pipes used by the gas companies) were laid down in the manner before mentioned, and an engine placed on them, having its wheels sufficiently fluted to cover rather more than one-third of the rails, it would travel along them in safety. The advantages gained by this sort of rail would be,—1st, the saving in the expense of laying them; 2nd, by the wheels being fluted they would tend to keep the rails in their proper position, instead of causing them to oscillate, as the wheels at present in use do; 3rd, the rails, being hollow, might be made to answer the purpose of draining the rail-road. I am aware that objections may be raised against this plan on account of its not being applicable to rail-roads already completed; but I think the curves, and the shifting on to other lines of rails (where the whole of the railway is laid down with cylinders), might be overcome, under the management of some of our clever engineers.

I am yours, &c. H. P.

P.S.—I should feel obliged to "Q.E.D." or any of your scientific correspondents, who would favour me with their opinions of the above plan, through the medium of your valuable Magazine.

## ANSWERS TO THE QUESTIONS IN No. 52.

*An inflexible cylindrical vessel, six inches in height, being filled, contains fifty cubic feet of water; let this vessel be placed with its base to the horizon, and closed in every part except a small hole in the top, into which a common quill is fitted, projecting two inches above the surface of the water. When this quill is fitted, how much will the pressure on the bottom of the vessel be increased?*

THE increase of pressure on the bottom of the vessel, produced by the water in the quill, will be 16,66⅔ ounces; or the whole pressure 56,666⅔ ounces, the weight of 50 cubic feet of water being 50,000 oz.

Effects of this kind have obtained the improper appellation of hydrostatical paradox; the effect is exactly what we are led to expect from the principles of hydrostatics, and equally consistent with the general principle of mechanics. It is evident that the whole surface supports the whole incumbent column of water; and when the weight of the water is equal in all parts, every equal portion of the surface will support an equal portion of the pressure. If we suppose the aperture of the tube to be 1-50,000th of the whole surface, the pressure on the corresponding part of the bottom of the vessel will be 1oz.; now, when the tube is filled, the height of the incumbent column resting upon that part of the bottom of the vessel which is immediately under it will be increased from 6 to 8 inches, and the pressure from 1 oz. to 1⅓ oz.; but fluids necessarily press equally upon all parts of a horizontal surface, otherwise there would not be equilebrium amongst the parts of the fluid. A lesser force supporting a greater, which is impossible; therefore, the pressure upon every portion of the surface equal to the aperture of the tube will be increased ⅓; and, consequently, the whole pressure will be increased ⅓, as before stated. If the resistance of the surface of the vessel be considered as the weight, and the water in the tube as the power, W × W's velocity = P × P's velocity, agreeable to the theory of mechanics. Q. E. D.

Digitized by Google

## ON STRIKES.

*To the Editor of the Penny Mechanic.*

Sir,—It is an established maxim, that it is always much more easy to discover an evil than to find a remedy for it; and had I adhered strictly to this rule, I might not have fallen under the censure of your correspondent, A. W. C.

Your correspondent alludes to the remark I made respecting the futility of the workmen striking on the occasion of any dispute, and makes a very lame attempt to convict me of inconsistency. I still hold that opinion, and beg leave to ask A. W. C. to point out what good can possibly arise, either to the masters or workmen, from the latter striking, considering the present relative positions of both. If a workman had nobody but *himself* to provide for, strikes might assume a very different complexion; but it is generally the case that an operative has a wife and family dependent on him: he can, perhaps, for a long time, bear privations himself, but can he bear the cries around him for bread unmoved, when any remedy is within his reach? Certainly not, it would be an insult to human nature to harbour such a thought; and driven by the cries of a starving family, he will, if possible, resume work on almost any terms. Where, in such a case, would be the *utility* of a strike? A strike can only be continued while the money of the operative holds out, and if the masters have more money than the men, it is clear enough who will surrender first. That worst of all rebellions, a rebellion of the belly, is not to be trifled with.

Your correspondent designates the hint I gave respecting *Trade Societies*, as "objectionable:" the plan (as stated in my letter) was mentioned at the last meeting of the British Association. It is not *my* plan, although I should not have the least objection to defend it at another opportunity. A remedy for strikes, come when it may, must be framed with extreme caution, and only after carefully considering the various details of this very intricate subject.

In the last paragraph of his letter, your correspondent says—"But when he asserts that they (the workmen in a strike) resort to gin-shops, I think he must hold the character of the mechanic in low estimation, by the many, for the vices of the few." This I maintain to be at present, unfortunately, the fact to a great extent, although it would be a libel to say that *all* would do so; I never said so, nor had I, I am happy to say, any reason to assert it.

A few words more, and I have done. A. W. C. says, at the close of his remarks, "All strikes that have been made within the last five years have been badly managed, or *they must have succeeded.* Among them were too many masters who manned (qy. marred?) the whole, and thus set aside *that good* that would most certainly have arisen, had they but *listened to the directors!*" I should very much like A. W. C. to prove what he here asserts, and to reconcile it with the first part of his letter, wherein he states he agrees with me, that strikes never can do good to the operatives. I am, Sir, your's, &c. J. F. S.

## METEOROGICAL SOCIETY.

Dec. 12, 1837.

Dr. Lee, F. R. S., F. R. A. S., in the Chair.

At this meeting were read exceedingly interesting papers relative to the *electrical phenomenon* which appeared on the night of Sunday, Nov. 12th ult., from Poole, Worcester, London, Edmonton, Manchester, &c.: but in some of these places were seen a sufficient number of meteors to constitute a *meteoric shower*, which has been so striking a feature in meteorology for several years past on the 12th and 13th of November. It appears, by a paper from Professor Olmsted, Yale College, U. S., that the meteoric shower was seen here in its usual splendour, but no meteors were visible till five minutes before one o'clock, A. M., on the 13th, at which time clouds prevailed at all the places from which accounts had been received by the *Meteorological Society*, which may account for no *meteoric shower* being visible at those places from which notices of the *phenomenon* had been received. Professor Olmsted says the maximum display took place between three and four o'clock in the morning of the 13th ult., and that 226 meteors were visible this year.

Mr. Woods, of 47, Hatton Garden, meteorogical instrument maker to the Society, exhibited diagrams of an instrument which has long been a desideratum among meteorologists,—a self-registering barometer; which, from the simplicity of its construction, and the getting up at no additional expense to the common barometer, there can be little doubt but the instrument will become generally adopted. Mr. Woods also exhibited his improved safety mountain and marine barometers, elegantly fitted up in bronze cases, so that they are calculated to stand high temperatures without being subject to the injury consequent on barometers mounted in wood cases, which invariably split in or about the latitude of 40°., to the injury

Digitized by Google

of ships at sea, and frequently to the great loss of property; and often that which is of much greater consequence, the loss of human life. This gentleman also exhibited his double registering thermometer, and an improved atmospheric thermometer; all of which instruments are constructed upon principles that not only do credit to the inventor, but will secure an accuracy in meteorological registers which has never till this period been arrived at. Engravings and descriptions of all these instruments will be given in the Society's Transactions, which will shortly be published. The meeting then adjourned till Dec. 26.

## MISCELLANIES.

*Royal City Medal.*—Messrs. Griffin and Hyams, of 22, Cornhill, have struck, in honour of her Majesty's late visit to the City of London, a medal of most beautiful workmanship, having a very faithful likeness of our youthful Queen on the front, and the reverse representing her Majesty receiving on the throne the Sword of Justice from the Lord Mayor, with various devices suited to the joyous and memorable occasion. The medal is struck in fine gold, weighing seven ounces, which may be seen gratis: also, from the same die, in silver, price 3*l.* 3*s*, bronze gilt 1*l.* 11*s.* 6*d.*, bronze 15*s.*; and in a particulerly pure white metal at 2*s.* 6*d.* each.

*Coloured Lithography.*—The iransaction of the society at Mulhausen announces a new invention by M. M. Engelman, which is coloured lithography; and, as a specimen, gave a landscape encircled by arabesques, highly and elegantly coloured. This is entirely effected in the press; and it is said the process is so simple, as to enable even an inexperienced workman to draw off a hundred proofs in one day. We should be glad if any of our readers could afford us any further information respecting this invention.

*Expedition to the South Pole.*—The French have fitted out an expedition to explore the antartic regions, and proceed, if possible, beyond the limits of Cook and Weddell.

*Gas.*—Does any of our readers know what is the origin or derivation of the word "gas?" The term gas sprang from the same source as ghaist or ghost, both being from a Teutonic word signifying spirit or supernatural being, and variously spelt gast, ghais, or otherwise, according to the different Teutonic dialects. Now, some of the mineral springs of Germany exhale a vapour which hangs above them in the semblance of a light thin cloud. This, being seen, was occasionally taken for a ghais or ghost; but those who had a little more wit at their finger-ends knew the thing to be neither more nor less than a vapour. From this deceptive appearance, however, arose the custom of applying the term ghais to all vapours or æriform bodies; and, being adopted by the continental chemists, the word soon became universal in this sense.—*Greenock Advertiser.*

*Falling Stones.*—An account has been received from Brazil, of the appearance of a meteor of extraordinary brightness, and as large as the balloons used by aeronauts. It was seen for more than sixty leagues in the province of Ceara, and over the village of Macao, at the entrance of the Rio Assu; it burst with a noise like thunder, and an immense quantity of stones fell from it, in a line extending more than ten leagues. The largest portion fell at the entrance of the river, and in various places they pierced through several dwellings, and buried themselves several feet deep in the sand. No human life was lost, but many oxen were killed, and others severly hurt. The weight of those taken out of the sand varied from one to eighty pounds.

*Singular Discovery.*—A singular discovery was made in Blaen-y-nant lead mine, near Mold, Flintshire, a few days ago. The workmen at the end of one of the levels were surprised, and obliged to run for their lives, in consequence of an immense rush of water suddenly bursting in upon them. After three days the water totally disappeared; and, on cautiously proceeding to the place, they found an opening through which the water had issued, of about four inches diameter. Hearing a sound as of a heavy run of water inside, they enlarged the aperture so as to admit of their passing through, and found that it was the bed of a subterraneous river, which in all probability affords the principal supply to the far-famed St. Winifred's Well at Holywell, from which it is distant about twelve miles. The stream being then shallow they explored it about sixty yards down, and were astonished to find several large caverns to the right and left, from the roofs and sides of which were suspended numerous and beautiful specimens of white spar or stalactites. The company are in high spirits, these appearances being considered favourable for a large lodgement of ore.—*Shrewsbury Chronicle.*

Digitized by Google

# THE CHEMIST.

## OIL OF VITRIOL;

Or, liquid sulphuric acid, is colourless, inodorous, and of an oily consistence; it is highly acrid and corrosive; its acid properties are extremely strong, so that a single drop gives to a large quantity of water the power of reddening vegetable blue colours; but when undiluted it has the property of turning vegetable yellow colours, brown, as the alkalies do, but is removed by water. Its boiling point is about 545°. and it solidifies at 15°. below zero.

Sulphuric acid has a great affinity for water. By exposure to the air in an open vessel it imbibes one-third of its weight in 24 hours, and more than six times its weight in a twelvemonth. When one part of water is suddenly mixed with fourtimes its weight of concentrated sulphuric acid, both at the temperature of 50°. it is raised to 300°.; but, according to Dr. Ure, the greatest heat is excited by mixing 73 parts of acid with 27 of water. The mixture of this acid and water always occupies less space than before combination, and the last-mentioned proportions more expecially, for the highest temperature is always succeeded by the greatest condesation. Its specific gravity is about 1·845.

Concentrated sulphuric acid acts very slowly upon the metals at ordinary temperatures; but at a boiling heat many of them decompose it, and are oxidized by combining with a portion of its oxygen while sulphurous acid is given out in the gaseous state. When diluted, it rapidly dissolves those metals which decompose water by its agency, as iron and zinc, with the evolution of hydrogen gas, and it dissolves the oxides of most other metals. It readily combines with the alkalies and earths, and forms with them various important salts.

Most vegetable and animal substances, owing to the carbon they contain, decompose and are decomposed by this acid; this renders it of a dark colour. Although it ought to be colourless, yet the slight colour it often acquires from the circumstance just mentioned, does not materially deteriorate it in quality or reduce its strength.

## AQUA FORTIS,

Or nitric acid, is a dense, colourless fluid; it emits white disagreeable fumes; its taste is extremely sour and acrid, and the skin is indelibly tinged of a yellow colour by it. When exposed to the air, it attracts water, for which it has considerable affinity; and when they are suddenly mixed, heat is evolved.

Nitric acid has usually a yellowish tint, owing to a small quantity of nitrous acid, formed by the partial decomposition of a little of nitric acid during its preparation. By exposure to light and expecially to the direct rays of the sun, it becomes first of straw colour and then of a deep orange, this change is owing to the evolution of oxygen, and the consequent formation of nitrous acid. If concentrated it does not act upon the metals in general, of ordinary temperatures, nor on some of them even when boiled in it: but when a little water is added, most of them decompose a portion of the acid and water also; and the metals combining with the oxygen of both, they are either oxidized and become insoluble, or are dissolved and converted into nitrates, by the nitric acid remaining undecomposed; during this action nitrous gas is given out, which uniting with the oxygen of the air, forms red nitrous acid gas.

It is decomposed by some combustible bodies with great rapidity, as by charcoal, by phosphorus and by sugar; its specific gravity is 1·50.

---

*Potato Brandy.*—M. Krauss, of Dusseldrof, has latley given his attention to the deleterious effects of the spirit extracted from potatoes, and which is in general use in the north of Europe, both as a liquor among the lower classes, and as the basis of a finer class of cordials, and some medicines. Several physicans have already pointed out its deleterous effects, but as the researches of chemists could not find any injurious principle in the rectified spirit, no attention was paid to this opinion. M. Krauss imagines that he has found out the difference between spirit of wine and spirit of potatoes, but he deems it much more important first to show the extraneous matter introduced into the latter, and to this he at present confines himself: he says, that not only is the rectification of the spirit but too often carelessly conducted, but the spirit itself is made from potatoes which are either rotten, or which have begun to germinate. Its effects upon the human frame he describes are most dreadful: producing delirium tremens, idiotcy, &c.; and as, from its cheapness, it is immoderately used, most of the crimes committed in Sweden and Rhenish Prussia, are due to the abuse and nature of this brandy.—*Athenæum.*

---

Digitized by Google

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—If you, or any of your numerous correspondents, could answer the following queries, as early as possible, it will much oblige,

Sir, your obedient servant,

C. PARKE.

1st. What is the cheapest apparatus I can employ, for obtaining the metal potassium?

2nd. In what manner can I analyse a certain compound (starch, for instance) so as to find the constituent parts, and the ratio in which they are combined?

3rd. What wax (if it be) is it, which is used for chemical apparatus, such as the corks of a Woulfe's bottle—*if not wax*, what is it, and how can I make it?

SIR,—I should be glad to know if any of your numerous correspondents can inform me, how I can unite essence of lemon with water, so as not to leave the oily water floating on the surface?

J. WILOUGHBY.

SIR,—You will very much oblige a Constant Reader by inserting the following queries:—

If C. Parke will give me an idea of mixing the colours for paper-staining, I shall thank him. Can any of your readers inform me how the lacquer is put on tin and other goods, to make them appear like brass? Also, what is used to scour woollen cloths, and how is it done? Also, a good cheap olive brown dye. Likewise, how the spirit is made, which is burned in the new lamp, that gives a brilliant light similar to gas? R. G.

Will any of your correspondents inform me of the best, or most suitable work on geology, (not an expensive one) for a person beginning that study?

H. A.

SIR,—I shall feel obliged if any of your correspondents can inform me of any composition that will answer the purpose of oil to machinery, working submerged in sea-water, and will not wash away or rise to the surface, but will adhere to, and preserve machinery exposed to the corroding effects of sea-water?

MACHINIST.

## ANSWERS TO QUERIES.

*To the Editor of the Penny Mechanic.*

*To prepare solar Phosphorus.*—Cleanse oyster shells by well washing; expose them to a red heat for half an hour; separate the purest part, and put it into a crucible in alternate layers with sulphur, till almost full; expose the vessel to a red heat for one hour at least; when cold, break the mass, and separate the whitest parts for use. When enclosed in a bottle, the figure of a watch may be distinguished by its light.

A. B. Y. Z.

*To make Phosphorus*.—If phosphoric acid be mixed with one-fifth of its weight of powdered charcoal, and the mixture distilled at a moderate red heat, in a heated earthen retort, whose beak is partially immersed in a basin of water, drops of a wavy-looking substance will pass over, and, falling into the water, will concrete into a solid, called phosphorus. It can be purified, by straining it through a piece of Chamois leather, under warm water.

The above are answers to "C. Boney," No. 50.

"A Young Mechanic," No. 54.—Immerse the seed for two or three days in oxymuriatic acid, after which sow it in a light soil, and place over it a metallic cover: then bring it in contact with an electric machine, and the plants will be produced in a few minutes. By the same agents as are employed in this process, eggs may be hatched in a few hours; water, in a short period, separated into its two component parts, oxygen and hydrogen, and by the same power restored to its former state; and platina, the most difficult metal to melt, can be fused and *calcined!* by the discharge of an electric battery.

"A. T. R." No. 51.—How magnets are made?—There are several modes in which a piece of iron may be converted into an artificial magnet. The following is a simple and ready method of doing so:—

Let a straight bar of hard tempered steel be held in a vertical position (or still better, in a position slightly inclined to the perpendicular, the lower end deviating to the earth), and struck several smart blows with a hammer, it will be found by this simple process to have acquired all the properties of the magnet. A. B. Y. Z.

"Inquisitor," No 59—Tracing paper, &c.—I think the following receipt will accomplish what you desire, viz, a good tracing paper:—

Nut oil, oil of turpentine, of each half a pint; rub the paper with the oil, and dry it immediately, by rubbing it with wheat flour; if washed over with oxgall, it will bear being written upon with ink.

"J. C. A.," No. 57.—For the purpose he requires naptha will be found the best substitute. To make it burn crimson or red a little nitrate of strontia should be dissolved in it; a green flame is produced by using boracic acid; and a yellow by the nitrate of barytes.

"R. H." No. 59.—The best way of joining glass tube, is by using the cement mentioned in the 1st vol. of this work, at the 208th page.

*To an Amateur Die-Sinker*.—The best way of hard ening fine steel, as engraved steel, needles, watch-pinions, &c. is to cover them with soap, previous to putting them in a charcoal fire.

SIR,—Presuming that your correspondent, who writes relative to the Cheap Pneumatic Trough, mentioned in a back number, has written the name "Brack" for "C. P.," I beg to inform him, the trough can be made to any size, suiting the purposes and convenience of the operator.

I am, Sir, your obedient Servant,

C. PARKE.

"L. D." Poplar.—Parchment size is generally used; but isinglass is an excellent substitute. Gum Arabic will make a very good varnish. C. S. B.

SIR,—If your corespondent, Tyro, wishes to obtain oxygen gas, he can do it by mixing equal weights of black oxide of manganese and sulphuric acid, in a glass retort, to the heat of an argand lamp, the oxygen will be expelled; by putting the black oxide into a quicksilver bottle, or other vessel equally convenient, and exposing it to a red heat, he will obtain oxygen. If he wishes to obtain large crystals of sulphate of zinc, he must evaporate the solution very slowly, until a slight skin is formed on the surface, and leave it to cool, it will then chrystalize.

CHINA.

ERRATA—No. 60, page 160, "Chloride," line 38, read *many of* "the mettles on fire;" and lines 41 and 42, read "which forms vegetable *compounds*."

## TO CORRESPONDENTS.

*We see nothing novel in the plan proposed by A. N. D., for preventing steam-engines getting off the rails. In the drawing he has sent us there is nothing more than the common wheels, with the flanches attached to them.*

*We have received* C. D. Thomas's *two papers on the nature and properties of steam, and will endeavour to find room for the first of them shortly.*

*Received* A Subscriber, A. Z., R. S., An Engineer, W. U., H. A., &c.

Apollo Chemicus.—*No.*

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,

## AND THE CHEMIST.

No. LXIII.] SATURDAY, JANUARY 6, 1838. [Vol. II.


## ELECTRICAL EXPERIMENTS.

FIG. I.

FIG. II.

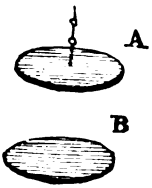



FIG. III.

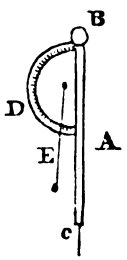



FIG. IV.

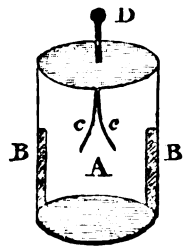



FIG. V.

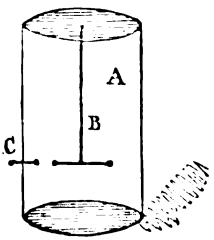



FIG. VI.

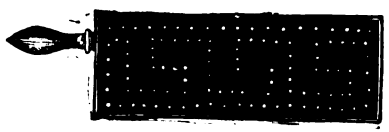


FIG. VII.

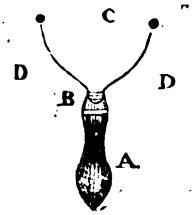
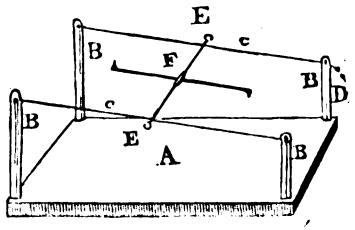



FIG. VIII.





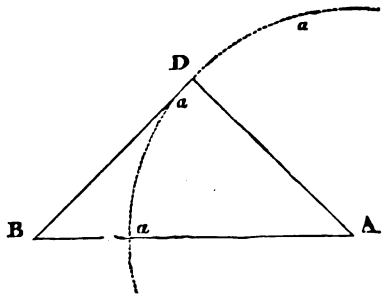
Vol. II.—No. LXIII. Holloway Press: D. A. Doudney.



Digitized by Google

*To the Editor of the* PENNY MECHANIC.

SIR,—Your Correspondent, "Q. E. D." is in error in the solution of the triangle in No. 58. In that solution the angle D is an obtuse one, and by that the acute angle, B, is diminished; but for increasing it the following diagram will explain:




Draw A B = greatest side, and with A *a*, = lesser side as radius: from the point A describe the dotted circle *a*, *a*, *a*; then, from the point B, draw B D, touching the circle *a*, *a*, *a*, on its circumference; and at right angle to B D draw D A; then B D is the length of the required side, and the greatest possible acute angle is D, B, A.

PRAESEPE.

## ON THE NATURE AND PROPERTIES OF STEAM.

### VIS VAPORIS.

STEAM is now the most powerful and generally-used prime mover of the present age. Steam is water converted into an invisible gas, or vapour, by the agency of heat. Under the ordinary pressure of the atmosphere water assumes the form of steam at 212° of Fahr., and the temperature of the water continues at this point, all additional heat going to form steam, which contains much more heat than boiling water; and the steam produced under these circumstances has an elastic force of about 15 pounds per square inch; viz. it balances the atmosphere pressure. And a cubic inch of water produces a cubic foot of steam, or 1728 cubic inches. If, however, the pressure be diminished or increased, the water will boil at a diminished or increased temperature. In a vacuum water boils at 70° instead of 212°, every inch of the barometer between 26 and 81, causing a variation of 1·76 of a degree. And according to Dr. Gregory, water, when pressed by a column of mercury five inches high, does not boil till heated to 217°, each inch of mercury producing a rise of 1°. The elastic force of steam thus varying, the determination of its force, at different temperatures, has occupied the attention of many experimental philosophers; viz. Watt, Southern, Creighton, Young, Tredgold, Perkins, Dalton, Taylor, M. Dulong, and Arago. Mr. Tredgold's rule combines the requisites of simplicity and accordance with the results of experiment. To find the elastic force of steam in inches of mercury of the barometer, at a given temperature of Fah. thermometer, add 100 to the given temperature, and divide the sum by 177; raise the quotient to the sixth power, and it will be the force required. Thus, if the temperature of the steam be 431 its force in inches mercury will be 729, or about 24 atmospheres. This rule applies only to pure water; and the less pure the water the greater deductions must be made from the above rule. When salt water is used, 177·6 or even 178, must be used as the divisor. C. D. THOMAS.

## MAGNIFICENT BRIDGE ACROSS THE WEAR.

OF the several great works now in progress calculated to increase and perpetuate the prosperity of this port, none, in a prospective point of view, has greater claims to attention than the Durham Junction Railway, and of which but little is publicly known.

The erection of the Durham Junction bridge was commenced about twelve months ago, and is from designs by T. Elliot Harrison, Esq., the Stanhope and Tyne, and Durham Junction Railway Company's engineer, who, so much to his credit, brought the works of this spirited proprietary to a satisfactory conclusion. The building of the bridge has been contracted for by Messrs. John Gibbs and Son, of Aberdeen, the gentlemen who constructed the bridge at Glasgow, and several other similar erections.

The bridge has four principal arches, besides three smaller ones on each side, inserted in the approaches of wing walls to lighten the masonry, and add unity to the design.

Of the four main arches, three are thrown over the valley, to obtain the requisite locomotive railway level; viz., one on the south side and two on the north side, the river Wear being entirely spanned by one splendid arch. The dimensions of the arches are as follows:—

Digitized by Google

1. Over the valley on the south side, 100 feet span.

2. Over the river Wear, 180 feet span.

3. Over the valley on the north side, 144 feet span.

4. Over the valley on the north side, 100 feet span.

The length of the entire bridge is 810 feet 9 inches, and its width between the parapet walls 21 feet. Over the bridge a double line of railroad will be laid, there being on each side a flagged footway.

But the extraordinary height of the bridge forms its most attractive feature. From the foundation of the main pier to the crown of the arch, is 72 feet; from the spring to the arch, is 72 feet; and from the crown of the arch to the parapet wall, is 13 feet; making in all 157 feet. From this, to obtain the height for the ordinary water level, we must deduct that portion of solid masonry buried beneath the waves, which makes the observable walling 130 feet; this being (I speak from memory) about 20 feet higher than the justly-celebrated bridge of Sunderland.

In the construction of this gigantic erection, no expense is spared. The stone, which is a hard, durable, well-coloured free-stone, is obtained from Pensher quarry, situated about a mile south of the place, the property of the Marquis of Londonderry, and the outer quoins of the large arches will be composed of granite. The foundations both for the abutments and piers, are based upon solid rock, to obtain which advantage it was necessary, in some instances, to excavate to the depth of 40 feet.

The bridge is formed with turrets above the piers, which will add greatly to its strength transversely; the parapet walls will be very substantial, and care has been taken by Mr. Harrison, the able engineer, to make the erection not only safe, but durable.

Notwithstanding that Mr. Gibb, the contractor, has had about 200 men at work for the last 12 months, the bridge is far from being completed. All the pillars are ready for the arches, which are in progress, particularly the one over the valley on the south. At present the first impression of a stranger visiting the works, must be one of astonishment, on account of the unusual height and massive description of the requisite framework. The stone blocks, and other materials, are raised to their destined positions by means of a steam-engine, and the other machinery for carrying on the work is of the best description.

The scenery around the bridge is of a bold rocky character, the steep banks being well wooded. On the north side the scenery is more tame, consisting principally of arable or grass land. The bridge by the river line will be about six miles from Sunderland, eight miles from South Shields, and eight miles from the city of Durham. The land on the south side is the property of the Earl of Durham, and on the north side of John Boulcot, Esq. The Junction bridge will not only, as already observed, present a fine object in the landscape, but, being in so elevated a situation, will command many interesting views, amongst others of Lambton Castle, which is only at a short distance.—*Railway Magazine.*

## TUBUS CALEFACTUS.

A VERY singular instrument for the generation and propagation of heat, is now exhibiting at the Jerusalem Coffee-house, Cornhill, the invention of Mr. Thomas Joyce. The one we have seen is an upright cylinder, about sixteen inches long, and six inches diameter, mounted on a tripod. Within this is some machinery, and a matter which, apparently without flame or smell of any kind, keeps up, with the assistance of the atmosphere, a combustive process, by which considerable heat is generated. The inventor assures us that he is able to generate heat to any extent, as for instance, to boil, roast, or bake; or smelt metals without the least offensive smell or liberation of any gas whatever. This is indeed the puzzle to all who have seen it. He has assured us that the principle, as a philosophical one, is new. That there is some sort of combustion going on in which the atmosphere plays an indispensable part, is obvious, inasmuch as unless it be suffered to enter, —which it does at the top, and increases or diminishes the heat according to the size of the aperture,—the heat sinks to nothing. These instruments are made of different sizes, according to the purposes they are intended for. The one above-mentioned is of copper and brass; and we were informed, at the expense of only 3d. per twelve hours, would maintain a room of 1,300 cubic feet, at the temperature of 60° or 70° Fahr.; one for a carriage, would cost only 1d. for fifteen hours. The fuel of it, it is said, need only be put in once in twenty-four hours, or even once a week, and will require no subsequent attention. Mr. Joyce has not yet finished the patenting of it, but has already orders for several thousand.—*Railway Magazine.*

Digitized by Google

## METEOROLOGICAL SOCIETY.

### Dec. 12, 1837.

Dr. Birkbeck, F. G. S., President, in the Chair.—After the reading of the minutes of the preceding meeting, and other preliminary business was gone through, the Society proceeded to examine the new Test Instruments made expressly for the Society's use, by Mr. Robert Carr Woods, 47, Hatton Garden* (instrument maker to the Society). The Barometer is a magnificent instrument, the proportion of the cistern to the calibre of the tube being as 50 to 1. a proportion which obviates the correction for capillary attraction.

The Self-registering Barometer is also a beautiful instrument, attached to which is a Six's Thermometer and sunsures, or De Luc's Hygrometer, as purchasers may require.

The Thermometers, Self-registering (day and night), and Double-registering, attracted much attention of the members present; as also did Daniell's Hygrometer. Sir John Ross, R. N., the president, as well as the other members present, expressed their high satisfaction at the close of the examination of the above instruments; and next proceeded to the examination of Mr. Wood's Mountain and Marine Barometer in bronze frames, which also gave great satisfaction to the members (see the report, Dec. 30th, vol. ii. No. lxii.)

The next instrument examined by the Society, was Lieutenant Morrison's, R.N., new Electrometer. This instrument is intended to ascertain the electric state of the atmosphere, that is, whether the electricity in the atmosphere is greater or less than that of the earth; if the former the magnet will deflect to the east, and is termed in meteoric language *plus*; if the latter the magnet will deflect to the west, and is termed *minus*.

The magnet is suspended by a gold thread, from a brass cup fitted to the upper part or apex of a conical glass, which is surmounted by a brass rod about two feet in length terminating in a point. A long discussion took place whether this instrument was properly an electric or an electro-magnetic instrument; the balance of opinion terminated in favour of the latter, in the present form. Sir John Ross suggested an improvement in the suspension of the magnet, which improvement will be made, and the instrument again submitted to the Society for examination. The improvement suggested by Sir John Ross was highly approved by Dr. Birkbeck, and the other members present, upon the conviction that the instrument will be rendered entirely an electrical instrument, and if so, it will be an exceedingly valuable one to the meteorologist.

Several donations of books was then announced by the secretary from the Academie Royale de Bruxelles; the Albany Institute, United States, America; and the South African Institution.

The meeting then adjourned to Tuesday, the 9th of January, when will be exhibited some beautiful diagrams illustrative of meteorological phenomena during a period of fourteen years; and particularly interesting papers read relating to the meteorology of the Volcanic Island of Teneriffe, during a period of eight years: with a description of one of the most interesting tempests known for many years. Friends to meteorology are cordially invited to attend.

* Observers, whether members of the Society or not, may have their instruments attested by the Society's standard, in forwarding them, free of expense, to Mr. Wood. Also all communications for the Society are to be directed to the Secretary, Mr. H. Wi[illegible]e, 47, Hatton-garden, London, where the laws of the Society may be had gratis.

## MISCELLANIES.

*Timber in a Ship of the Line.*—A regular seventy-four gun ship requires 3,000 oaks to build her; these trees would require 100 acres for their growth, and would be nearly 100 years in coming to maturity—3000 oaks would timber 1,000 cottages for as many industrious families, who would add to the national wealth by their useful pursuits; and this would be a far more profitable way of disposing of oak timber.

*Southampton Railway.*—Contracts are entered into for the completion of the deviation line sanctioned by the last session of Parliament, by which the tunnel at Popham will be avoided. The works have been commenced with a degree of activity which astonishes the inhabitants of that part of the country. From Basingstoke to Winchester, the entire length is in the chalk formation, and can therefore be worked during the winter to the mutual advantage of the labourer and the contractor,—giving to the former employment at a season of the year when work is scarce, and to the latter, a plentiful supply of workmen.—*Railway Magazine.*

Digitized by Google

# THE CHEMIST.

## CHEAP ELECTRICAL EXPERIMENTS.

Let a person stand upon a stool with glass legs (necks of wine bottles), and hold a chain attached to the conductor of the apparatus; sparks of fire may be drawn from any part of his body by a person touching him; care should be taken that the chair, stool, or any part of his body or clothes do not touch the furniture of the room.

Fig 1.—Make a wooden head, the more frightful the better; then get some long hair and fit it on the head; a wire must be placed into the neck, about 4 inches long: then place it in the hole on the top of the conductor, and the hair will stand on end, presenting a most frightful spectacle.

Fig 2.—Get two pieces of round wood, and coat them with tin foil; fix a chair on the top of one (A), which fix to the conductor of your machine; then place the bottom one (B) underneath; previously make some elder pith men; place them between the plates, and they will dance up and down as if alive.

### ELECTROMETERS.

Fig 3.—Electrometers are to indicate the presence and the stength of, electricty. The following is a description of them:—Fig 4 is one of Hewley's. A, a piece of wood terminating in the ball B; the reason of the ball is, because none of the electricty shall fly off a point, as all points should be avoided in your apparatus. At C there is a brass wire to fit it in the hole on the conductor: D an ivory circle marked round the edge to tell the strength of the electricity; E a fine piece of wood, terminating in a pith ball, fixed to a pivot in the centre of the ivory plate.

Fig 4 is one on Bennet's principle, being more tender. A a glass jar; B the sides, coated with tin-foil half way up; C C, two pieces of fine gold leaf attached to the ball C, to which the electricity is applied, when the gold leaf, if the least electricity be present, will separate; and if much, will cling to the tin foil at the sides.

Fig 5 is one on Coulomb's principle. A a glass jar; B a fine silken thread, with a fine piece of wood having a ball of pith on each side; C a fine wire fixed in the jar, for which a hole must be made at each end. There should be a metalic ball; a pin, for instance, with a head at both ends. When the electricity is placed to the ball C, the pith balls will turn one way or another, for which purpose the glass jar is marked into degrees.

### LUMINOUS CONDUCTORS.

Fig. 6 represents a luminous conductor, (A); a piece of glass plate is the best, but common window-glass will do; B a handle to hold it by. Place the ball C to your conductor, and you will see [this should be done in the dark] sparks of fire darting along the dotted marks in a continuous stream; the dots should be made of round pieces of tin-foil; in this manner many pleasing devices can be formed.

Fig. 7 represents a discharging rod. A a glass handle; C two balls placed upon D D, which should be upon a hinge at B, to open or close them at pleasure; but for cheapness, you can make the handle of wood. Get a piece of wire and bend it in the required form; fix on two electrical balls, and put it into the wooden handle. In discharging a jar care must be taken that you touch the tin foil on the outside first, or you will receive the shock. Of course this will not do at all times.

Fig. 8 represents the working power of electricity. A a wooden board, into which are fixed four glass pillars, B B B B; the two which stand opposite D are to be shorter than those placed at the back of the board; from the top of these stretch fine wires, C C; at D have a chain attached to your conductor; place on the wire a wheel made of four pieces of wire, two to be bent round at the ends, F, F; fix them in piece of wood F; the other two to terminate in a point and to be fixed in the piece of wood the contrary way to the others; the points to be bent, the one up and the other down, as seen in the engraving: the electricity passes over the chains B, up the wire C, on to the wheel, and off at the points, which causes it to turn round and wind itself up the inclined plane. In this way I have drawn small weights up.

## ARSENIC.

It must not be thought that in speaking of arsenic, we refer to that substance in its pure metallic state; no, for it is then almost without any of the injurious effects which, when combined with oxygen, or white oxide of arsenic, makes it worthy of our examination. In this form it is vended by the chemists and druggists for the purpose of destroying the vermin infesting houses; but the persons using it seem to forget the aptitude of these creatures to run over their own eatables, and the ease with which they can transfer by their feet the poison intended for themselves to the stomachs of their enemies. Or again,

Digitized by Google

these parties may have purchased more than they can use in the manner just described, the remainder is then put by on a shelf, cupboard, or any other convenient place; and never again, perhaps, thought of, until the servant by mistake accidentally mixes it with the food, and produces those melancholy effects which we daily see in our news journals. It is our intention then, here to give a few of those tests which will enable any individnal to discover whether this poison is combined with any substance it is his wish or intention to use.

1st. Let the substance suspected to contain arsenic be dissolved or well soaked in pure rain water (distilled water is better), then add to the solution a little potass, and afterwards a little sulphate of copper, when if it be present a faint green colour will be produced.

2nd. Add one or two drops of ammonia and a little nitrate of silver in solution, when a yellowish cloudy appearance will be perceived in the liquor accompanied with films or streaks of the same colour, descending to the bottom of the vessel containing it.

3rd. Force a stream of sulphuretted hydrogen (made by mixing a little proto-sulphuret of iron in a small retort, with muriatic acid, and applying a gentle heat) into the solution, and a golden cloud will pervade the liquid.

Ammoniaret of copper (formed by adding diluted ammonia to sulphate of copper in solution), will also, when added, produce a yellow colour.

Iodine may also be used as a test.

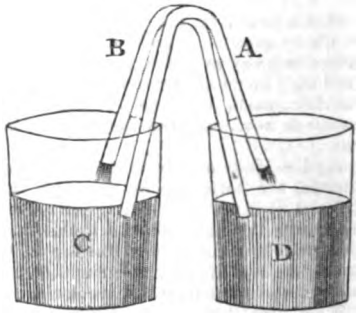
Before concluding this paper, a word may be said with regard to the bad practice of cleansing decanters, wine bottles, &c. with leaden shot; these, as it is generally known, always contain arsenic, and if one or more of this shot be left in a corner of the bottle (as is often the case) it must impart its injurious qualities to the wine, &c., put in that bottle.

W. BURBRIDGE.

## PERPETUAL MOTION.

*To the Editor of the* PENNY MECHANIC.

SIR,—Although I think that perpetual motion can never be obtained (for it is plain that all materials will, in time, wear out), yet I think motion, as long as the materials last, and with very little friction, can be obtained by the simple contrivance now laid before you. Let two syphons, exactly corresponding in size, be placed so that they shall pour water into two tumblers, or basins, as shown in the drawing, in which A B are the two syphons, and C D are the two tumblers




thus, while the syphon A is pouring water into the tumhler D, the syphon B is pouring water into the tumbler C; and as the syphons are exactly equal, they take out and pour in exactly the same quantity of water, producing motion as long as the materials last. Yours, &c.

W. F. P.

[We are perfectly satisfied that our correspondent has never produced perpetual motion by his plan; but as we have received several similar communications from other subscribers to our Magazine, we have inserted his letter and diagram. Our readers who are unacquainted with the law of hydraulics, must bear in mind that the leg of the syphon from which the water is to flow must be longer than the one in the vessel. The air being then drawn from the conduit, the pressure of the atmosphere on the water inside the vessel will force the fluid up the short leg, and it will descend through the long one by its own gravity.]

## CHLORINE.

CHLORINE was discovered in the year 1774 by Scheel, during his researches on the nature of manganese, and called by him *dephlogisticated marine acid.* It was termed by the French chemists *oxygenized muriatic acid*, which was afterwards contracted to *oxy-muriatic acid*, from the supposition that it was a compound of *muriatic acid*, and oxygen. We are indebted to Sir H. Davey for the appellation it now bears; he had the honour of overthrowing the old theory, and substituting in its place that which is commonly called the *new theory of chlorine.* Chlorine gas

Digitized by Google

may be obtained by mixing concentrated hydrochloric acid, in a glass flask, with half its weight of finely-powdered peroxide of manganese. Effervescence, owing to the escape of the gas, takes place, which may be increased by the application of a moderate heat. It should be collected in inverted glass bottles, provided with ground stoppers over water, warm or saturated with common salt, owing to the fact that the gas is absorbed by cold water. Its colour is a yellowish green. It has a very disagreeable smell, with an astringent taste, and is highly injurious when respired, even when considerably diluted with atmospheric air. Dr. Faraday has succeeded in condensing it into the liquid form by subjecting it to a pressure equivalent to about four atmospheres. Cold water absorbs about twice its volume of chlorine, and yields it again when heated. It is a non-conductor of electricity, one of the negative electrics, and a supporter of combustion. If you put a burning taper into a jar of chlorine, it burns with a small red flame for a short time, and emits a large quantity of smoke. Phosphorus takes fire in it spontaneously. Several of the metals, such as tin, copper, antimony, &c. &c. when introduced into chlorine, in the state of powder, are suddenly inflamed. It possesses no acid properties; it does not redden blue flowers when introduced into it. Its strong affinity for the metals is sufficient to prove that it is not an acid: for chemists are not acquainted with any instance of an acid combining directly in definite proportions with a metal. Chlorine is useful for the purposes of fumigation; but one of the most important properties of chlorine is its bleaching powers; but this I shall leave to a future opportunity to discuss. Chlorine may in general be easily known by its colour and odour. It may be detected chemically by its bleaching powers, and by adding a solution of nitrate of silver, which occasions a dense white precipitate (chloride of silver), which becomes black on exposure to light, soluble in ammonia, but insoluble in acids.

JAS. THOMSON, JUN.

*Making Coffee.*—Professor Donovan, in his work lately published on "Domestic Economy", recommends the following plan for making coffee as far preferable to any of those generally adopted. He says infusion in boiling water extracts the aroma without the whole of the bitter; and long boiling extracts all the bitter but dissipates all the aroma; hence we may infer that any effective degree of boiling must be in a slight degree injurious. The right mode of proceeding is therefore obvious; the whole of the water to be used is to be divided into two equal parts; one half is to be placed with the coffee in the coffee pot, and as soon as the liquor comes to a boil, it should be allowed to subside for a few seconds, and then poured off as clear as it will run. Immediately the remaining half of the water at a boiling heat is to be poured on the grounds; the vessel is to be placed on the fire and kept boiling for about three minutes. This will extract all the bitterness left in the grounds; and after a few minutes' subsidence the clear part is to be poured off, and mixed with the former liquor. This mixed liquor now contains all the qualities which originally existed in the roasted coffee in perfection, and it is as hot as any taste could desire it; by some processes it is much cooled, but there is little doubt that the pungent aroma of coffee is perceived by the palate more acutely when the liquor is very hot, and the fact is generally admitted.

*Weight of the Human Body.*—M. Chaussier dried a human body in an oven, the original weight of which was 120 pounds: when dry it was reduced to 12 pounds. Hence the solid matter of the body was water as 9 to 1, or one tenth. From this it will be seen how great a proportion the fluids of the body bear to the solids.

*An Earthquake in Rutland.*—On Friday night last, about 11 o'clock, the shock of an earthquake was felt throughout the vale of Catmos. There were three trepidations, in succession, and so violent as to shake substantial stone houses to their bases. Some rushed out of their houses, imagining it was an explosion of gunpowder in some neighbouring conflagration. A similar convulsion, but not so powerful, occurred also three weeks ago. The shock was, about the same time, felt in Stamford and the neighbouring villages. —*Lincolnshire Chronicle.*

*Vegetable Physiology.*—M. Mirbel has been making some observations on the cambium of vegetables, in which he confirms the opinion of Grew and Duhamel, that all vegetable tissue has been cambium at first, or mucilaginous matter, of extreme delicacy, which he, in other terms, names cellular mucilage.

Mr. Hartley has discovered that brass protects both wrought and cast iron from the action of salt water; and, contrary to all previous experiments on electro-chemistry, he states that the brass itself remains unaffected.

Digitized by Google

## INSTITUTIONS.

*Mutual Instruction Society, 16, Great Tower-street.*—The first Lecture for 1836 was delivered on Jan. 1, by Mr. Davenport—Question—Which is the best mode of Improving the Condition of Mankind?

Jan. 8, Mr. Carstairs on Beumanship—Second Lecture.

The second Anniversary Supper of the above Institution will take place on Jan. 9, 1838, at Short's Strand Hotel.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Can you or any of your Correspondents inform me what liquid is used to turn albata white?

INQUISITOR.

SIR,—You will oblige me by inserting the following queries in your periodical:—1. How to take the bottom out of a phial or bottle.—2. Where to buy the large black lead pots to make Aikin's furnace.—3. How to make a composition to line a large Mongolfier balloon, to prevent it firing.

SIR,—I should be glad to be informed, through the medium of your valuable and interesting publication, the principal on which the vane acts, which is at Lloyd's coffee-room, Royal Exchange, so as to indicate the state of the wind on a dial, which is fixed within the room.

SIR,—Can any of your Correspondents inform me of some amusing experiments with phosphorus; also the way in which different colours on cloth are dyed; and also, the most approved method of quick-silvering looking-glasses? C. C. W.

SIR,—Will any of your Correspondents have the goodness to inform me of the most simple way of constructing an electro-magnetic apparatus, and why sulphate of copper is used? H. A.

SIR,—Can any of your intelligent Correspondents inform me of any public museum where I can gain information on geology, or where I can see the crust of the earth stratigraphically arranged? I am sorry to say the British Museum does not contain anything of the kind. H. A.

## ANSWERS TO QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Your Correspondent, C. D. Thomas, informs me, that with regard to the iron tube to the gas bottle (No 61), I had forgotten the subsequent contraction of the iron on its becoming cold. If he would take the trouble to make the experiment, he would find himself entirely mistaken; for whatever the subsequent contraction of the iron might be, it is not near equal to the prior expansion caused by the heat. He also states that the iron bottle would cost but 7*d.*; but whether he be correct or not, I will leave more experienced judges than he appears to be to decide.

J. EVANS.

If "Goddard" is in possession of our back numbers, he will find several receipts for joining the gores of paper balloons.

"A Subscriber," No. 61. If you stamp sal-ammoniac, and mix it with water, it makes white ink, which cannot be read till held to fire, which makes it black.

"H. O." No. 61. There is a very good and large magic lantern, without slides, for sale, at a miscellaneous repository in the New-cut, six doors from the Victoria Theatre. T. B.

"H. P." is informed, that cylindrical rails have been invented, and also patented, I believe, some time; but why they are not used, I know not. They are, in my opinion, superior to those in general use; and I have never seen any objections to them. They would weigh less if used semi-cylindrical; and by having a flange, could be easily fastened to the bearers. C. D. T.

*Illustration of the Art of Calico Printing.*—1st. *To produce a White Pattern on a Black Ground.*—Let a piece of white calico be dipped in a cold solution of sulphate of iron and dried; then imprint the figures upon it with a strong solution of colourless citric acid, and let this dry also. If the piece be then well washed in warm water, and afterwards boiled in a decoction of logwood, the ground will be dried either a slate or black colour, according to the strength of the metallic solution, while printed figures will remain beautifully white.

2nd. *To produce a Scarlet Pattern on a Black Ground.*—Dip a piece of white calico in a strong solution of acetate of iron (which may be made by boiling sulphate of iron with acetate of lead), dry it by the fire, and lay it aside for three or four days. After this, wash it well in hot water, and then dye it black, by boiling it for ten minutes in a strong decoction of logwood; and, lastly, rince it in water, and let it dry. Now any figures printed upon it with a colourless solution of muriate of tin, will acquire a beautiful scarlet colour, though the ground remain black. I hope your Correspondent "B" will find the above to succeed. I believe them to be the ones in general use, but as I have not tried them, cannot speak from experience.

J. R. W.

SIR,—I beg to inform "Charlemagne," I have an electrical machine to dispose of, with several apparatus. Apply to C. B., 70, Chapel-street, Pentonville.

SIR.—"J. Hilton" should peruse "Griffin's Chemical Recreations," Tegg, Cheapside, as the best practical work on the subject.

Your Correspondent "C. Boney," who inquires how to make phosphorus, is informed that he can procure it at Dymond's, 146, Holborn-bars, at the rate of 2*s.* 6*d.* per ounce, The process for obtaining it is not only dangerous but troublesome in the extreme. Oyster shells do not contain any appreciable quantity, and phosphorus is never obtained from them; it is procured from hones calcined, mixed with charcoal, and distilled from an earthen retort into water; it is purified by straining through leather immersed in hot water.

I would recommend to "H. Kigdon," who wishes to know the best work on the arts and sciences, to Partington's British Cyclopœdia, two volumes, in monthly parts, price 1*s.* each. CHINA.

## TO CORRESPONDENTS.

G. L. M.—*We have so many plans for parachutes and balloons before us, that we scarcely know which to choose. Our Magazine will shortly contain an engraving and description of one on a new principle.*

*The plan for an electrical telegraph sent us by* L. *shall appear in a fortnight*

*We thank* J. R. Watts *for the papers he has sent us.*

C. T. *need not be afraid of the working classes being deprived of employment by the establishment of a Polytechnic School on Mr. Hawkins's plan; for, according to his own letter, the rich will never send their sons to labour for their bread; and the poor will not have it in their power; therefore the institution will only exist in name.*

Tyro Locke's *paper on measuring timber will, no doubt, be useful to many of our readers.*

John Miles's *plan for propelling boats, is nothing more than the Archimedes screw; the properties of which are well known to all scientific men.*

*Received*—G. A. Patterson—T. L. M.

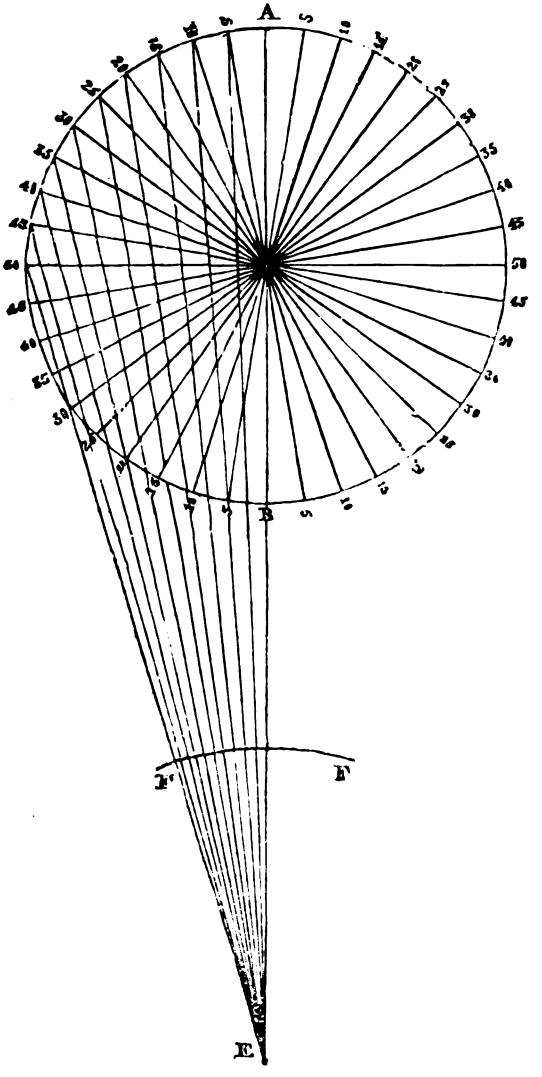
London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LXIV.] SATURDAY, JANUARY 13, 1838. [Vol. II.

### MATHEW'S METHOD OF CALCULATING STEAM POWER.






Holloway Press: D. A. Doudney

Digitized by Google

## ON STEAM POWER.

*To the Editor of the Penny Mechanic.*

SIR,—I beg to return thanks for your kindness in giving insertion to my communications in your instructive little work; also to C. D. Thomas for his answer (vol. 2, page 78) to the question I put (vol. 1, page 273), relative to the power of steam-engine cranks in communicating motion to machinery.

That the power exercised by a single engine upon the crank, does not exceed more than one-third its revolution, or, that the united power of double engines in steam vessels with cranks at right angles, does not exercise a power of more than two-thirds their revolution, is mere conjecture. In order to elicit facts, my wish is to see the present mode of calculating mechanical power simplified down to the comprehension of unrefined working mechanics. The subjoined table, showing "the force which the connecting rod has to turn round the crank at different parts of the motion," is copied from a work by Robert Brunton, entitled "A Compendium of Mechanics, or Text Book," calculated in common decimal arithmetic. I shall feel obliged if C. D. Thomas, or any of your correspondents, will explain the table, and render it as clear as possible to the comprehension of plain educated working men, who may not understand decimal arithmetic.

I also beg to submit a simple plan for the opinion of your Correspondents, by which I assume to prove that the united power of two engines does not exceed the power of one engine upon every part of the revolution of the cranks and paddle-wheels in propelling steam vessels; that is, that two engines, say of fifty-horse power each (which is supposed by many persons to combine a power of 100 horses), does not exceed a power of 50 horses in driving the vessel forward.

I remain yours, &c.

T. M.

The following Table shows the force which the connecting rod has to turn round the crank at different parts of the motion:—

Col. A. Decimal portion of descent of the piston, the whole descent being 1.

Col. B. Angle between the connecting rod and crank.

Col. C. Effective length of the lever, upon which the connecting rod acts, the whole crank being 1.

Col. D. Decimal portion of half a revolution of the fly-wheel.

Col. C. Also shows the force which is communicated to the fly-wheel, expressed in decimals, the force of the piston being 1.

| A | B | C | D |
|---|---|---|---|
| ·0 | 180 | ·0 | ·0 |
| ·05 | 151½ | ·46 | ·128 |
| ·10 | 141 | ·62 | ·158 |
| ·15 | 131½ | ·74 | ·228 |
| ·2 | 123½ | ·830 | ·271 |
| ·25 | 117¼ | ·892 | ·308 |
| ·3 | 110¾ | ·94 | ·342 |
| ·35 | 104 | ·976 | ·377 |
| ·4 | 97½ | ·982 | ·41 |
| ·45 | 91¾ | 1· | ·441 |
| ·5 | 88¼ | 1· | ·473 |
| ·55 | 80 | ·986 | ·507 |
| ·6 | 75 | ·956 | ·538 |
| ·65 | 69 | .92 | ·572 |
| ·7 | 62½ | ·88 | ·607 |
| .75 | 57½ | ·824 | ·642 |
| ·8 | 49 | ·746 | ·68 |
| ·85 | 42 | ·66 | ·723 |
| ·9 | 34 | ·546 | ·776 |
| ·95 | 23¼ | ·390 | ·84 |
| 1·0 | — | — | 1·0 |

EXPLANATION OF ENGRAVING.

The circle is divided for a 50-horse power, each division being five horses each.

In proportion as one crank is advancing from the top dead-centre A, to full power, or extent of leverage D, in equal proportion does the other crank recede from full power D, to the bottom dead centre at B.

When the cranks of two fellies are at any part of their circular motion, add the two numbers opposite together, and the combined power will be 50 horses.

The perpendicular lines passing through the horizontal line C, D, to E, represents the length of leverage from the centre at different parts of the motion.

## ON TIMBER MEASURING.

*To the Editor of the Penny Mechanic.*

SIR,—I send you the following remarks upon the present system of timber measuring, showing in a very clear light the great error in the common practical rule. As these remarks are founded on experimental facts, they may be of some use to practical mechanics, and very probably may help to dispel the very erroneous system now in use. I am very well aware that the error has already been often described, and very

Digitized by Google

energetically pointed out by men of eminence, as well as by practical men. It is something unaccountably strange, that in the present time, when every body are striving to correct and dissipate old errors, that those materially interested in the subject, should so neglect their interests and exhibit so much apathy in this respect, as to be guided by an erroneous rule in their pursuits. In the ordinary affairs of commerce, accuracy is the great aim, and we are well aware, the greater the accuracy the more beneficial it is to the merchant and the public generally. Are we then to imagine that timber merchants are a class separate in manners and customs from other merchants, that they pay so little regard to accuracy in their dealings. I will admit that they may be sufficiently strict in their dealings in every other point, save that of the great error in their practical method of computing the contents of their timber, and consequently in the value, for if the measurements are erroneous, the value must be so to. But to proceed to our subject. Round timber is seldom of the same uniform diameter or circumference throughout, but varies very materially, and, as a consequence, before any idea of the content can be had, we must get an average area or circumference. Trees are generally tapering; this is more or less according to circumstances, and the figures of their sections are irregular ellipses, distorted circles or trapezias, &c.; and the main difficulty, I apprehend, is to find the mean area of their irregular sections, or girths, as they are more commonly called. The general method I recommend, is to examine the tree, and if it varies but little, or tapers regularly, we may take two or three measurements, and the mean of these may be taken for the average area of the sections; but if the trees are very irregular, it would be the most accurate to divide it into a number of lengths; then suppose one of these lengths to taper regularly, take the mean of it as above; if the rest should be angular or very distorted, take its girth according to the nearest figure you suppose it resembles, &c., and take the mean of the whole; but the shortest way is to divide it into several equidistant lengths, and take the girth at each, and the mean will be sufficiently accurate. Having thus premised the general way of girting, we will proceed at once to an example, and exhibit the difference, showing the great inaccuracy of the present rule. Suppose the length to be 66·22 feet, and this to be divided into seven different lengths, and the girth of each length to be measured, which in this case has been accurately determined, then it will be as follows:—

No. 1 ... 38·6, length being 60·22.
2 ... 38·5
3 ... 37·7
4 ... 38·0
5 ... 87·5
6 ... 37·7
7 ... 37·3

7÷265·3 sum.

2÷ 37·9 mean average girth.
4÷=18·95=½ girt, or ¼ circumfer.
9·457=¼ mean girt.

And to find the diameter corresponding to this circumference, in order to get the area, we have 355 : 113 :: 37·9 : 12·063=diameter; then ½ circumf. × ½ diameter=area.

18·95×6·03=114·268=mean area,

which multiply by the length, 66·22 will be the solid contact computed as a cylinder.
∴114·2685×66·22=7566=content, omitting decimals.

Now as a companion, find the content
Square ¼ mean girt =9·47)²=89·68 multiplied by length, will give the content
∴89·68×66·22=5945 omitting decimals, and obviously this value deducted from the preceding, will display the error

=7566
5945

1621 omitting decimals,

which is the error of old rule; and I can now show you that it is even considerably more than this, for by immersing the timber in a cylinder whose dimensions were accurately determined, and filling with water, the true content was found by gauging to be equal to 7592, omitting decimals, whence 7592 } omitting decimals
5945 }

1647 true difference,

which enormous quantity is obviously lost to the timber growers, and strongly points out the necessity of a better rule. It can be readily seen, that the growers lose *nearly* 25 *per cent.* of their timber through this egregious inaccuracy.

In my next I will give you the new rule, and one or two of the experiments for ascertaining the errors. The experiments were not made by myself, but put into my hands by a clever practical mechanic.

TYRO LOCK.

Digitized by Google

## ELECTRICAL TELEGRAPH.

*To the Editor of the Penny Mechanic.*

Sir,—I am sorry that my first communication on the electrical telegraph has not been received. Has there been a conspiracy in any quarter against it in its present embryo state? I shall be afraid to trust them again, and therefore must take Paddy's method of writing a letter, and bringing it myself.

The plan proposed, is for the accomplishment of an instantaneous communication between two persons, say 500 miles asunder, or to any distant part of our island, by means of the electric fluid. This may by some be considered a wild or extravagant, if not foolish idea, and yet a momentary intercourse by letters to and fro, for for instance, London and Edinburgh, is certainly a consideration of some moment.

The plan then simply consists in laying under ground a small iron pipe, containing as many stout wires as there are letters in the alphabet, and terminating with a metal ball to each wire. They may be lettered from A to Z, and kept in their relative situations throughout the tube by circular pieces of any nonconducting substance, which may be found to answer the purpose, each piece being of course perforated in a corresponding way to allow the wires to pass through. No breaks or chain links to be allowed, but where it becomes necessary to join the wire, it will be better to have it soldered, to prevent any loss of the fluid. A metal stand to conduct the fluid to the earth will be required, having a face and balls to correspond with those at the mouth of the telegraph, and to be placed at a convenient distance for receiving the spark.

The person, then, who is writing to Edinburgh, will just have to spell his words upon the wires, by discharging a jar for each letter, which letter will be given out in Edinburgh at the same moment, and may be written down as they appear. When the communication is finished, the stand may be removed, and an answer returned to London in a similar way.

My reason for making it thus simple, is to adapt it to the use of any person who can read and write, that private correspondence may also be carried on in this way as well as public. I think the cost of a telegraph of this description will be very trifling compared with advantages to be derived from it.

Yours respectfully, L.

Fig. 1.

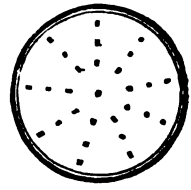


Fig. 2.

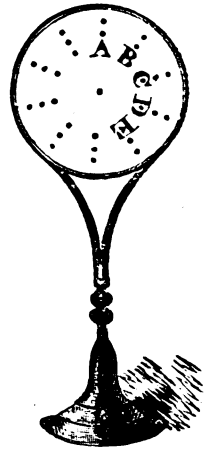



Fig. 1. The mouth of the Telegraph.
Fig. 2. The receiving stand, by which the fluid is to be conducted to the earth.

## ON THE ANTIQUITIES OF TARA HILL.

At a meeting of the Royal Irish Academy, Mr. Petrie, by permission of Col. Colby, read the first part of a paper on this subject, being a portion of the memoir written to illustrate the Ordnance Map of Meath, now on the eve of publication. The author first gives a detail of the mode of investigation adopted. An accurate survey and ground plan of the locality was first procured. Translations were then made by Mr. O'Donovan of such ancient Irish MSS. as could be found relating to the subject of inquiry; the different copies, were such existed, having been carefully compared, so as to obtain the greatest possible accuracy in the text. Those of chief value, two poems and a prose tract, are compositions of the tenth, eleventh, and twelfth centuries, and are contained in the ancient

Digitized by Google

Irish topographical work called the Dinseanchus, copies of which are preserved in the books of Lecan and Ballymote, in the possession of the Academy, as also in MSS. in the College Library, and in the library of the Duke of Buckingham at Stowe. Of the poems, one is the composition of Cinaeth O'Hartigan, who was chief historian of the northern half of Ireland, and according to the annals of Tighernach, died in 975. The other is the work of Cuan O'Lochain, who, according to the same authority, was killed in 1024, having been for the two previous years, chief poet and lawgiver of Ireland, after the dismemberment of the monarchy in the person of Maelseachlin the Second. The prose tract is not of equal antiquity with either of these pieces, but is more copious in its descriptive details, and is of a date at least prior to the twelfth century. The writer appears to have personally examined the monuments remaining in his time, and often describes their state of preservation with remarkable exactness. From a comparison of the accounts given in these documents with the monuments ascertained by the survey to be still in existence, not only all the remaining vestiges have been identified with sufficient certainty to warrant the insertion of their respective names on the map, but the localities also of several other monuments of less importance, but which are now wholly effaced, have been so far determined as to furnish full materials for the construction of a ground plan, exhibiting a restoration of the whole. The number of these monuments, and the great extent of ground which they cover, will be at once evident from an inspection of the map; and, as a striking instance of the heroic interest possessed by them, it may be shortly stated, that the strongest evidence has been adduced, from MSS. much more ancient than any hitherto cited on the subject, to show that a remarkable obeliscal pillar-stone, which now serves as a head-stone to the grave of the rebels who fell here in 1798, is the celebrated *Lia Fail*, or coronation stone of the Irish kings, which has been generally supposed to have been carried into Scotland by the Dalriadic Colony in 503, and thence to have been taken by Edward the First into England, where a stone alleged to be the same is still shown under the coronation-chair in Westminster Abbey.—*Athenæum.*

## NEW STEAM-BOAT PROPELLER.

*To the Editor of the Penny Mechanic.*

Sir,—You would much oblige an admirer of your valuable Publication by the insertion of what I think will prove a great improvement for steam-vessels, as the present mode of propelling by paddle-wheels is so cumbrous, unsightly, and likewise noisy. My plan which I propose is to propel by worms running parallel under each side of the vessel; and the vessel so built as to project rather beyond the worms to protect them from injury; the suggestion once published, I think would soon be tried by some of your practical readers, and I have no doubt would be found so far superior to the paddle-wheel, that it would soon be very generally used. The manner of applying the power of the engine to it, I may safely leave to those who have had experience as engineers.

John Miles.

## MISCELLANIES.

*Gunpowder Engine.*—After years of labour, and many disappointments, sustained only by patience and perseverance rarely equalled, Mr. J. Smith, of Dysart, has completed a machine, which he terms a gunpowder engine, and which moves with great ease, against a weight of twenty-six hundred weight on the square inch of the piston, equal to a column of water a mile and a quarter high. And yet, with this enormous power, the machine is so perfect, that not a particle of leakage proceeds from any part of it. Nor is it possible to increase this power by any effort of the person to whose care the machine may be intrusted—a circumstance which renders it perfectly safe. Mr. Smith calculates the saving in the use of his machine, as compared with steam, to be fully eighty per cent., whilst the space it occupies is not one-twentieth of that taken up by the steam-engine.—*Caledonian Mercury.*

*Russia.—St. Petersburgh.*—On Saturday, Nov. 11, the iron railroad from this city to Czarskojeleso was opened. There were 150 persons conveyed in eight carriages, four open and four covered, drawn by one steam-engine of forty-horse power, manufactured by Mr. Stephens, in England. The distance of twenty-one versts and a half (fourteen miles) was traversed in thirty-seven minutes in going, and in twenty-eight returning.—*Railway Mag.*

It is expected that the Croydon Railway will be opened its entire length by the 1st of May, 1838.

Digitized by Google

# THE CHEMIST.

## THE THERMOMETER

Is that instrument which indicates the variations in the intensity of heat or degrees of temperature, by their effect in expanding some body. The first attempt to measure the intensity of heat was made more than two centuries ago, and has since that time received many improvements. The honour of the invention is by some conferred on Drebel, by others on Sanctorio, and by others on the celebrated Galileo. The material used was atmospheric air. A glass tube, open at one end, with a ball blown upon the other, was slightly heated so as to expel a portion of the air from it, and then the open end of the tube was dipped under the surface of some coloured fluid, which was allowed to rise into the tube as the air cooled and contracted. When heat is applied to the bulb, the air in it is expanded and depresses the column of coloured fluid in the tube. The common air thermometer is rarely used. But a useful modification of it was described by Sir John Leslie in 1804. This instrument was said to have been invented a century and a half ago by Sturmius, but had fallen into disuse until revived by Leslie. It consists of two thin glass balls joined together by a tube bent at right angles. Both balls contain air, but the greater part of the tube is filled with sulphuric acid coloured with carmine. If both balls be equally heated, the air in each is equally expanded, and the liquid between them remains stationary; but if the one ball only be heated, then the air in that ball is expanded, and the liquid depressed. Hence it is the difference of temperature between the two balls which is indicated. Owing to the great expansion of gases, and the small expansion of solids, it is obvious that we must search amongst the liquids for a material whose expansion is less than the one and greater than the other, and of course exempt from both extremes, for the construction of a thermometer. A material is required whose expansions are uniform, and whose boiling and freezing points are very remote from one another. Mercury fulfills these conditions better than any other fluid. No fluid can support a greater degree of heat without boiling than mercury; and none, except alcohol and ether, endure a more intense cold without freezing. In making a thermometer the first object is to take a tube with a bore, being like a hair in magnitude, and of the same diameter through its whole length. Satisfied with the bore, the thermometer maker melts one extremity of the tube, and blows a ball upon it. He then rarefies the air within the ball, and dips the open end of the tube into distilled mercury, which is forced up as the air cools and contracts, entering the ball to supply the place of the expelled air. He then boils the mercury so as to drive out the remainder of the air. Having done this, his next step is to seal the open end hermetrically, which he does by heating the ball so as to make the mercury rise near the summit, and then suddenly close the aperture by fusing the glass before the mercury has had sufficient time to recede. He has now an instrument with which he can ascertain the comparative temperature of bodies. The next object is to graduate it, which is done by obtaining the freezing and boiling points. The former is easily done by plunging the ball of the thermometer into melting ice till the mercury becomes stationary: and the latter, by plunging it into boiling water; care being taken that the water be perfectly pure, and the barometer stand between twenty-nine and thirty inches. You then divide the interval between the freezing and boiling points of water into any number of parts or degrees which may be drawn upon a piece of paper or ivory and attached to the thermometer. In the centigrade thermometer this interval is divided into 100°, the freezing of water being marked 0°, the boiling point 100°. In this country we use Fahrenheit's scale, of which the 0° is placed at 32° below the freezing of water, which therefore is marked 32°, and the boiling point 212°, the intermediate space being divided into 180°. Another scale is Reaumer's, the freezing point is 0°, and the boiling 80°. These are the principal thermometers used in Europe.

JAS. THOMSON, JUNR.

## ON THE ELEMENTS.

### NO. II.

### HYDROGEN.

HYDROGEN is the lightest of all known bodies, being 14½ lighter than air, 50 cubic inches weighing about 1 grain. Its name is derived from its property of forming water with oxygen, combining in the proportion of one to eight of oxygen: it is highly inflammable, burning with a blue flame, (the gas burnt in the shops is carburetted hydrogen).

To prepare hydrogen take one ounce of zinc in pieces, three ounces of water, and ¾ oz. of sulphuric acid, mix the acid with

Digitized by Google

the water, and then add the zinc, the acid and the zinc take acid from the water, forming sulphate of zinc, and the hydrogen escapes and may be collected over water, or, for experiments where great accuracy is required, over mercury. Iron filings may be substituted for xinc; but in that case the acid must be added gradually. It may also be obtained from water by electricity.

Compounds of hydrogen are called hydrates, as milk of sulphur and fused potass, hydrate of sulphur, and hydrate potass.

Oxygen and hydrogen when burnt together produce an intense heat, and may be used for reducing metals, &c. The mixture is very explosive.

## CURIOUS CHEMICAL EXPERIMENT.

*To the Editor of the Penny Mechanic.*

Sir,—A friend of mine lately showed me this experiment, which I think is entirely new. If a piece of phosphorus be placed on a little iodine, the action on each other is so intense, that they burst into a brilliant flame. The proportions of the two should be: two parts by weight of the latter, to one part by weight of the former.

In Ure's Chemical Dictionary it is stated, that phosphorus and iodine combine *without light*, but in the above proportions light is produced.

A. B. Y. Z.

## CARBONIC ACID.

If a piece of ignited charcoal, fixed to a copper wire, be introduced into a jar filled with oxygen gas, beautiful scintillations are thrown to all parts of the vessel, which causes intence heat. During the combustion, the carbon of the charcoal combines

| | |
|---|---|
| Carbon..... | 6 |
| Oxygen ..... | 16 |
| Joining Carbonic Acid.. | 22 |

The usual process resorted to for its preparation, is not that mentioned above: common lime-stone, chalk, marble, &c. (being all carbonates of lime) are employed; the marble, for instance, is Introduced into a Woulfe's or other convenient apparatus in fragments, and hydrochloric (muriatic) acid, poured on in sufficient quantity to cover the marble; which combines with lime, forming muriate of lime, and expels the carbonic acid gas, which can be either collected in a dry stopper-bottle, or passed through water; that element absorbs its own bulk of the gas, which is carbonic acid. The agreeable flavour of ales, cider, and many wines, is owing to the presence of this gas. It extinguishes flame, and combines with the earths, &c. The specific gravity can be found in the following manner:—100 cubic inches of oxygen weigh 33,9153 grains; 100 cubic inches of carbonic acid weigh 49,5973 grains (Thompson): the difference, 12,682, is consequently the weight of the carbon, that combines with 100 cubic inches of oxygen, and that exists in 100 cubic inches of carbonic acid. Then, as 30,8115, (the weight of 100 cubic inches of common air), is to 46,5973, (the weight of 100 cubic inches of carbonic acid) so would the number 1,000, or unity, be to the number 1,5123, the specific gravity of carbonic acid.

*Beautiful Vegetation of Metallic Silver.*—Bend a piece of thin copper wire into the shape of a tree, or any other figure you choose, and lay it upon a piece of glass; then pour over it a few drops of a strong solution of nitrate of silver, or lunar caustic. In a few minutes metallic silver will be seen shooting out from the side of the copper wire, and will really appear as if it were growing.—N.B. You must be sure that your wire lays *quite flat* upon the glass, otherwise the experiment will not succeed.

*To remove Iron-mould from Linen, &c.*—Cream of Tartar, ½ oz., 3*d.*; Powdered Salt of Sorrel, ½ oz., 1*d.* Mix. The above is what is usually sold at the druggists in little oval wooden boxes, price 1*s.*, under the name of salt of lemons. By preparing it yourself, you will save at least 300 per cent., that is, the above quantity will cost 4*d.*, and will fill nearly a box and a half. The directions which generally accompany it are as follow:—"Put boiling water into a basin, then put a pewter plate upon it, wet the spot with water, and dip your finger into the powder, or put a small quantity to the spot, rub it gently, and the ink or iron-mould will entirely disappear, without the least damage to the lace, lawn, muslin, &c." It is a generally-received opinion, that spirits of salts, or muriatic acid will remove iron-mould; this, however, is false: muriatic acid, diluted with about four parts of water, will *instantly* remove *recent* ink stains, but *not* iron-mould. Salt of lemons is the *only* articl that will.

Digitized by Google

## INSTITUTIONS.

*Southwark Literary Society.*—Wednesday, Jan. 17th, the Marquis de Spinetto on the Origin of Romance.

*Mutual Instruction Society, 16, Great Tower-street.*—Jan. 15, Mr. Cowen, on the Ancient Drama.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—I should take it as a favour if you or any of your Correspondents would inform me of the means to make Indian rubber impervious to oil used in machinery. A constant reader, W. W.

SIR,—C. D. Thomas will much oblige by informing me where I can procure a cast-iron bottle for 7*d.*, such as he recommends to a "Young Chemist." I shall be glad also to know if any of your readers can furnish me with the arrangement of the lenses, &c., used in a reflecting microscope, similar to that employed at the Adelaide Gallery.

SIR,—You would much oblige a constant reader, if, through your useful magazine you would inform me whether condensed steam could return through the same pipe from which the steam enters, without stopping the steam-cock.

SIR,—Will any of your Correspondents favour me through the means of your valuable periodcial, with a description and diagram of Nullin's sustaining galvanic battery. APOLLO CHEMICUS.

## ANSWERS TO QUERIES.

"A Subscriber," No. 53. *How is an electrophorus made?* It consists essentially of two parts; one being a flat cake of resin, made by pouring melted resin into a circular dish of tinned iron, with a rim round it, and the other a dish of brass of rather smaller dimensions, to the centre of which is fixed a glass handle. I presume that "A Subscriber" knows this is an electric machine. about 20 sparks from the upper conductor being efficient to charge a small Leyden phial. A. B. Y. Z.

SIR,—The wax "G. Perke" speaks of, is a solution of the finest sealing wax (a compound in which there is no wax) in rectified spirit. It is applied with a brush.

SIR,—A Correspondent inquires how to take the bottom out of a vial. Make a tobacco pipe, or piece of iron wire, red hot, and apply it to the part wished to be separated, then touch the glass with a little spittle on the finger, and so all the way round; the glass will break exactly where you lead with the hot wire. Black-lead pots may be had at Farmer's, in St. John's-street, an ironmonger; or at Foster's tool shop, in St. John's-square. G. A PATTERSON.

For the information of "A Subscriber," No. 61, I subjoin some processes for making sympathetic or invisible inks.

1. Write with a weak tincture of galls, the characters will be invisible; but moisten the paper with a feather dipped in a weak solution of sulphate of iron, and the writing will become black.

2. Write with a weak solution of prussiate of potass the letters will be invisible; moisten the paper a above, and the writing will appear blue.

3. Write with a weak solution of nitrate of silver, and let the writing dry in the dark, and it will be invisible. Keep the paper folded up and in a dark place, it will continue invisible, but expose it to the light of the sun, and it will become black.

4 Use a solution of sulphate of copper, no writing will be visible. Wash the paper with a solution of prussiate of potass, and the letters will appear of a reddish brown.

5. Characters written with a weak solution of muriate of copper, are invisible when cold, but yellow when heated.

6. Dissolve oxide of cobalt (zaffre) in acetic acid, and dilute the solution with water; write therewith, the characters will be invisible until heated, when they become blue.

7. Dissolve in a sand-bath for some hours, one part of cobalt, or zaffre, with four parts of nitric acid, add to the solution one part of muriate of soda (common-salt), and four times as much water as acid, then filter the solution. The above is invisible whilst cold, but green when heated. The three last mentioned inks will recover their "invisibility" upon cooling, if the paper has not been made too hot. F. E. L.

SIR,—In answer to "C. Parke's" question, "*What is the cheapest apparatus I can employ to obtain the metal potassium?*" I am not aware of any other means than that employed by Sir Humphrey Davy; viz.,—he placed thin pieces of potash, rather wet, on a plate of platinum, attached to the negative end of a powerful galvanic battery, and brought a platina wire from the positive end of the battery to its upper surface; by this method the potash is gradually decomposed, oxygen gas is evolved at the extremity of the positive wire, while small globules of a white metal resembling mercury, appear at the opposite side in contact with the plate of platinum.

Third Query.—I have always found a wax composed of shell lac well powdered, two ounces, and resin one ounce and a half, melted slowly over a gentle fire, answer very well for the purpose. He mentions, it may be coloured with vermillion, or ivory black, according to the colour required.

"R. G." *How to lacquer tin and brass articles:*—The lacquer can be purchased at any oil shop, or can be made in the following way:—Take one pint of spirits of wine; three ounces of *seed* lac; digest for some time in a moderate heat, then strain the liquor, and colour it with gamboge or annotto to the shade required. To apply it, clean the article well, and make it moderately warm on an iron plate over a charcoal fire, and apply the lacquer with a clean camel-hair pencil, very thin, and all one way. ERASMUS.

## TO CORRESPONDENTS.

*If the Secretaries of the different Literary and Scientific Institutions in London will favour us with their lists of Lectures for the first quarter in 1838, they shall be inserted as usual.*

*We have had several letters sent us from Subscribers and others, with particulars of Books and Chemical Apparatus for Sale, the insertion of which would subject us to the advertisement duty. Now we think it would be of more advantage, both to them and us, if they were in future to send them in the shape of Advertisements, to be inserted in our Monthly Wrapper.*

"A Subscriber's" *letter is of too political a nature for our columns. He had better send it to the Dispatch.*

*We have no recollection of "J. G.'s" paper on nitrate of silver.*

*We perfectly agree with our Correspondent (who signs himself "A Mechanic"), that the genius of the working man in this country is neither rewarded nor protected. We hope before long, the law of patents will be so remodelled, that the inventions of the poor man will be secured to him by paying a small sum of money at the Patent Office, to have his discoveries registered.*

"W. Evans." *The Society of Arts and Sciences for rewarding genius is in the Adelphi, to which place he must direct his letters, with every particular relating to his invention. With regard to the latter part of his letter, we think his plan is an improvement on the present method.*

*Received*—Alpha—A Friend to the Penny Mechanic—A Constant Subscriber.—L. M., &c. &c.

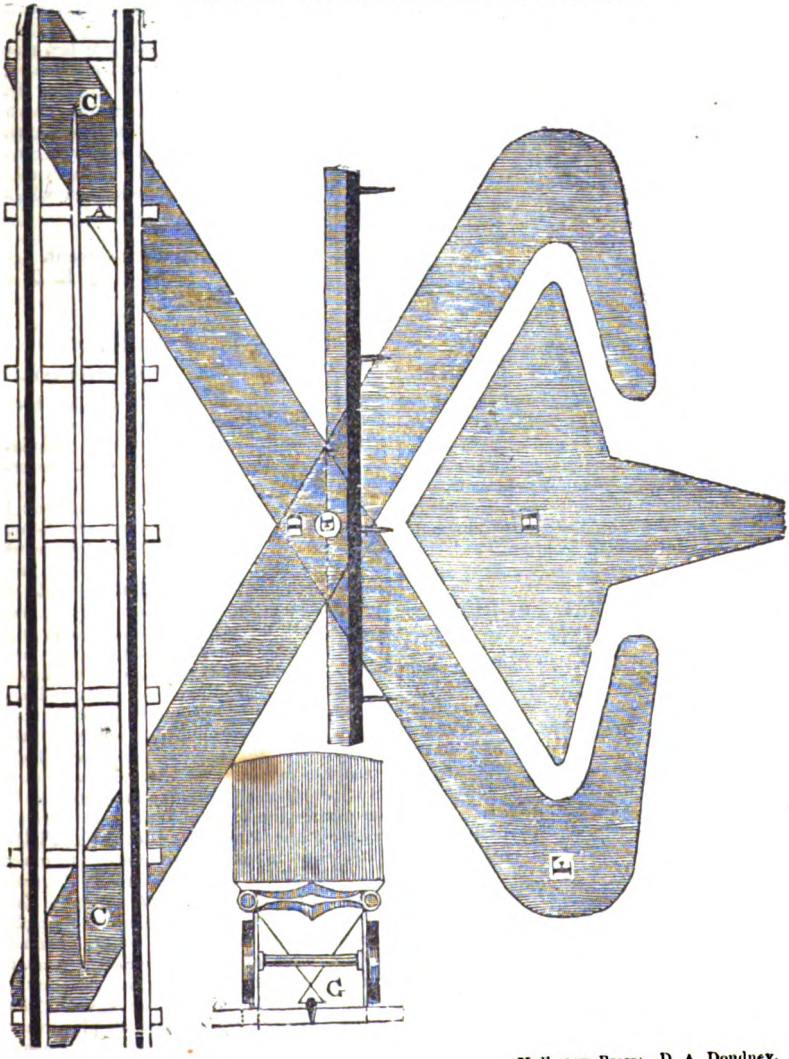
London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LXV.] SATURDAY, JANUARY 20, 1838. [Vol. II.


VAUGHAN'S SAFEGUARD FOR STEAM CARRIAGES.





Vol. II.—No. LXV.

Holloway Press: D. A. Doudney.



Digitized by Google

## SAFE-GUARD FOR STEAM CARRIAGES.

*To the Editor of the Penny Mechanic.*

SIR,—If you will have the kindness to insert the following in your valuable work, I shall feel greatly obliged. My design is that for a safe-guard for steam carriages for those parts of the line most exposed to danger, for the guides may be cast to short or long lengths as required; the height of the guide may be according to the carriage, as the extremity of each end of the guard is fastened to the carriage bottom, and each end has a contrary bearing. The guard may be fastened with either chains or bars, with shear joints, so as to open if rubbed against the rail of the guide. With one to each carriage, I think they may pass over the most dangerous drains, embankments, or bridges, with the greatest safety; the expense will be but little compared with the safety, if it will but answer, and if not, it may give the idea to some skilful inventor. I have no pretensions to mechanics, but am a lover of the science.

I am Your Constant Reader.
*Bristol.* T. W. VAUGHAN.

DESCRIPTION.—A, transverse section of sleepers; B, the guide, to be spiked to sleepers; C, the point or end of guide; D, the safe-guard to slide on guide; E, the rivet or pin of slide to small guide; F, the guard, full size; G, front view of guard, full size; H, section of the guide; the safe guard one-quarter inch from guide.

## THE MECHANICAL PROBLEM OF "BOZ."

THERE now, Mr. Editor, if I had dissected the nonsense which appeared in Number 56, over the signature "W. J.," I should, doubtless, have been thought "too severe," and so forth; but I should also have saved Mr. Praeseppe (in your last Number, 63) from the mortification of becoming the butt of his geometrical friends. That he is unacquainted with mechanics, or even the elements of geometry, is evident; and my opinion is, that some good-natured friend has practised a hoax upon him; and when he is made aware of the nonsense he has written, he will, doubtless, feel as I do myself, that, even in Christmas gambles, it is ungenerous to indulge in merryment which exposes our friends to unpleasant ridicule.

The false and unqualified affirmation that "Q. E. D. is in error," is in itself blameable and offensive, and peculiarly ungracious from one who is totally ignorant of the subject to which it refers; but if I have thrown a pearl before some "Praeseppes," I trust it is also exhibited to geometers who appreciate its nature, and admire its beauty. I dare say this language will offend some pigmy minds; but I feel no more hesitation in pointing out the beauty of a problem when it happens to be my own geometry, than I do in admiring a flower because I gathered it myself.

The demonstration of this problem may not occur to every amateur of mechanics; I will therefore, with your permission, Mr. Editor, give an ample explanation, which I think will not be found uninteresting. I make it the subject of a separate communication, that it may not be associated with the very unprofitable matter which has given rise to these remarks.

I remain, Sir,
Your obedient servant.
Q. E. D.

## ON LEVELLING.

*To the Editor of the* PENNY MECHANIC.

SIR,—As much attention of late has been given to the improvement of roads, a few remarks on the subject may not be uninteresting to the majority of your numerous readers.

But before entering into the subject I am inclined to fancy a few short articles on levelling will not be misplaced, by way of preamble or introduction. It is not my intention to enter into all the details of the practice of levelling in all its branches, but content myself by giving, clearly and perspicuously, the general principles on which it is based; giving only so much geometrical reasoning, and verbal illucidation, as may be absolutely necessary for a thorough comprehension of its principles. From the experience I have had, I am well aware that there is frequently an appearance of difficulty in understanding clearly the rules and methods used in reducing the observations from the Field-book when taken, preparatory to forming a section of the line, from these observations. I say appearance of difficulty, for I am sure that after perusing the simple constructions, and proofs which I intend giving, most of your readers will concur with me in acknowledging its simplicity, even in the most intricate cases. The geometrical diagrams will display very clearly all the principles, and, as I hope, let my readers into the very marrow of the matter, instead of being content with

Digitized by Google

feeding upon the mere superfices, as many whom I know are content to do. I am more particularly alluding to students in engineering, most of whom are, to my knowledge, content with a few verbal rules, and rely upon field-work for proficiency. To be sure practise makes the man; but let me add that theory is an able and useful assistant even to the practical man, who are so much given to ridiculing the opinions of theorists as mere chimeras. If, instead of relying upon the mere verbal rules delivered by others, they were to form a little syllabus of their own, I feel well assured they would soon make most of these difficulties that are met with in reducing sections, vanish. And instead of keeping what little they may discover in their practice to themselves, to no purpose but self-gratification, were to acquaint each other, it would be for their mutual good. The principle of levelling has been kept by the few initiated as a complete mystery, if I may be allowed such an expression, as though the knowledge of them were some inestimable benefit; the consequence was, that during the late demand for levellers for railroads, very few were found capable; and I am well assured that most, even of the *professed surveyors* had to take instructions from others in this most important part of their profession. I can say myself, that being frequently out with an eminent surveyor, he had four professional surveyors learning levelling; these facts are well known, and many learnt levelling for a mere temporary purpose. After these remarks it may be expected for me to shine out and dispel the mist; but I arrogate to myself no such idea, and shall give no more than what any one acquainted with levelling might make for himself. So much by way of introduction. I now proceed to explain the various technicalities used, which may tend to simplify the following remarks:—

### DEFINITIONS AND AXIOMS.

Levelling is the method of ascertaining the variation of the surface of the earth between any two given determinate points.

The ground is said to "fall" when it declines in the direction of the levelling track, and "rise" when it inclines to it.

A "first or back" sight, is that first taken, and is always contrary to the direction of the chainage. A "fire or second" sight, is taken immediately after the last back sight, and is always in a contrary direction.

A "successive or simultaneous" series of sights, are those taken in the line of chainage, and all referred to the same back sight line of direction; a chainage is that line in which the levels are taken from one place to the other, and consequently joins the two places.

And we may take it for granted, as an axiom, that any distance measured on the surface of the earth between any two points is not the shortest or horizontal distance; this in the case of great length is too plain to require any explanation, and for short distances it may be altogether neglected; the proofs are easy and numerous. For levelling very short distances, such as yards, &c. for drains, the foundations of houses, &c., a wooden frame is mostly used on the sling and plummet system, called a "levelling frame," which, for every practical case, is sufficiently accurate. The principles of this instrument are but very little different from those of the spirit level, and what applies for one will for the other. For long distances the spirit level is always used on account of its superior accuracy and expedition, some use the theodolite; but this being a combined instrument, is not so much used as the spirit level; it requires much more care in adjusting, which is not always an easy affair, and it is much more liable to get damaged. This instrument is always used in trigonometrical surveys, both for levelling and taking the angles, for which latter purpose it is more directly applicable. I shall here assume my readers as perfectly acquainted with the form and construction of each of these instruments, as a description of them would extend this paper much longer than originally intended; but we may here notice that there is not much difficulty attending the use of the spirit level, and a few days practice will be of much more service in acquiring a competent practical knowledge of the use of the instrument than a month's hard reading. Every object appears inverted through the telescope of the instrument, from the general laws of optics, viz. that of having only two glasses; this property of the instrument occasions some laughable blunders to the young practitioner, which at first excites surprise, but soon vanishes by use. In giving any directions to the man at the staff, you must take care to reverse the appearances, or he will do just the contrary of what you intended. With these remarks I conclude the present article; my next will continue the subject in due order.

I am, &c.

TYRO LOCK.

Digitized by Google

## ON PENMANSHIP.

*To the Editor of the Penny Mechanic.*

SIR,—PERCEIVING by your last Number of the "Penny Mechanic," that a lecture would be delivered by the celebrated Carstairs on the Art of Penmanship, I attended his lecture, and with pleasure have to acknowledge the delight I experienced in witnessing the self-evident advantages which can be obtained from his excellent and superior modes of instruction. From the able manner in which he treated the subject, his elucidations were not only in accordance with reason and common sense, but truly scientific and philosophical.

His observations on the natural and correct mechanical means, which every one has the power to put in practice, were completely conclusive; by the aid of which the valuable art of writing can be acquired, not only in the utmost perfection, but a facility of execution is positively secured, and permanently retained, through every period of life. I have frequently heard of Mr. Carstairs' systems of writing, but it was not until I attended his excellent lecture on Monday evening, that I was fully satisfied of their utility, which proved really a gratifying treat to me, being at once convinced of the high importance of his wonderful and varied means of conveying information on the subject, and in my opinion, the only satisfactory and rational way that could be devised for the complete acquirement of two of the grand requisites in penmanship, namely, symmetry of the form of the letters, and the greatest possible facility of execution, commonly called command of hand.

Mr. Carstairs has handsomely offered his services to all who may be desirous of availing themselves of the same; and as he is about to deliver lectures in various scientific institutions in London, I strongly recommend your readers to attend, and reap the same valuable information which those who heard him have received. I remain devotedly Yours,

15, Curtain-road. F. WILBY.

## ON THE NATURE AND PROPERTIES OF STEAM.

NO. II.

VIS VAPORIS.

WHEN, by the continued accession of heat, steam acquires an elastic force capable of sustaining a column of mercury sixty inches high, it is then said to possess a force of two atmospheres, and so on in proportion to the height of the column of mercury it will support. Taylor's experiments determine the force of steam up to 180 inches of mercury, or six atmospheres. M. Dulong and Arago, being appointed for the purpose by the French academy, experimentally ascertained the force up to twenty-five atmospheres, and hence by calculation up to fifty atmospheres. The rule derived by them from their experiments is as follows:—

To find the elasticity of steam in atmospheres at very high temperature, subtract 212° from the given temperature, multiply the remainder by .003974, and add one to the product, and raise the sum to the fifth power, and it will be the force as required. The following table is the result of their experiments. The columns marked T contain the different temperatures, and those marked A their corresponding forces in atmospheres.

| T. | A. | T. | A. | T. | A. | T. | A. | T. | A. |
|---|---|---|---|---|---|---|---|---|---|
| 212·00 | 1 | 331·70 | 7 | 408·92 | 18 | 457·16 | 30 | 491·76 | 42 |
| 233·96 | 1½ | 336·86 | 7½ | 413·96 | 19 | 460·45 | 31 | 494·27 | 43 |
| 250·52 | 2 | 341·96 | 8 | 418·46 | 20 | 463·64 | 32 | 496·72 | 44 |
| 263·84 | 2½ | 350·78 | 9 | 422·96 | 21 | 466·74 | 33 | 499·14 | 45 |
| 275·18 | 3 | 358·88 | 10 | 427·28 | 22 | 469·78 | 34 | 501·50 | 46 |
| 285·08 | 3½ | 367·34 | 11 | 431·42 | 23 | 472·73 | 35 | 503·85 | 47 |
| 293·72 | 4 | 374·00 | 12 | 435·56 | 24 | 475·64 | 36 | 506·16 | 48 |
| 301·28 | 4½ | 380·66 | 13 | 439·34 | 25 | 478·46 | 37 | 508·40 | 49 |
| 308·84 | 5 | 386·94 | 14 | 443·16 | 26 | 481·24 | 38 | 510·60 | 50 |
| 314·24 | 5½ | 392·86 | 15 | 446·82 | 27 | 483·95 | 39 | 512·80 | 51 |
| 320·36 | 6 | 398·48 | 16 | 450·38 | 28 | 486·59 | 40 | 514·82 | 52 |
| 326·26 | 6½ | 403·82 | 17 | 453·82 | 29 | 489·21 | 41 | 517·08 | 53 |

Digitized by Google

At very high temperatures there is a great difference between the results of the French and English experiments. Mr. Perkins states the force of steam at 419° Fah., to be thirty-five atmospheres; whereas, by the above experiments, it is only twenty atmospheres. Mr. Perkins also states in the specification of his high-pressure engine, that if the steam-generator be made sufficiently strong to withstand 60,000 lbs. load on the valve, the water would not boil, although it would exert an expansive force of 56,000 lbs. on the square inch, and the temperature will be about 1170° or cherry red, which Mr. Galloway affirms is proved by recent experiments. Now as 15 lbs. per square inch is the pressure of the atmosphere, this would give nearly 4,000 atmospheres; and calculated by Tredgold's rule it would be 4,500 atmospheres, and by the French rule only 2,567 atmospheres, or 38,000 instead of 56,000 per square inch.

The fact is, the law of the elastic force of steam varies much between high and low temperatures. Tredgolds rule is pretty correct as far as six atmospheres, and the French more correct above this pressure, at least up to about 50 atmospheres.

C. D. THOMAS.

*To the Editor of the Penny Mechanic.*

SIR,—One of your Correspondents wishes to know the principle on which the vane acts, to indicate the changes of the wind by a dial at Lloyd's Coffee Room, Royal Exchange. I am not aware how that one is effected, but he may make a dial in the following simple way:—Connect an iron rod, so as to turn with the centre of the vane; to the end next the dial attach a bevelled wheel, to act in a similar wheel with the same number of teeth. The arbor of this wheel is squared, and comes through the centre of the dial; upon this square the hand is fixed.

A SUBSCRIBER.

## MISCELLANIES.

DURING the present shooting season, and in prospect of that for fishing, we think we cannot do our sporting readers a more seasonable service, than by directing their attention to "*Darton's Thirty Miles round London*," which is truly one of the most complete and beautiful maps we ever beheld. The spirited manner in which Messrs. Darton and Clark have got up this and a variety of other useful and interesting subjects, have justly entitled them to the liberal support of the public at large. We have before us likewise another very able production, to which their names are affixed, entitled, "*The Stream of Time.*" It has now, we believe, been before the public for some months, and, considering the expensive manner in which it has been brought out, has had an extensive sale. On the one side of "*the Stream*" is the history of the world, on the other, that of the church; in each of which, the more interesting and important particulars are introduced, in a form well calculated to impress the youthful reader. The printing is by Messrs. Green and Co., of Bartlett's-buildings, and for its clearness and beauty, does them great credit.

*Cashemire Manufactory.*—General Papkoff, who possesses large property at Crassnokuta, in the government of Jékaterinoslaw, has established there a manufactory of Cashemire wool, the first which has been introduced into Russia. On the same spot he has collected a large flock of Angora goats and Merino sheep, has introduced a number of new plants, and discovered a coal mine.

*Inhaling Silver.*—It is said in one of the French papers, and professedly from Professor Silliman's Journal, that on opening the mules, after death, which have been employed within the Mexican mines, from two to five pounds of silver are often found in their stomachs, and that he has several specimens of it in his possession, the metal being perfectly white and pure.

*New Mammalia.*—Some new animals have been discovered in Australia, a portion of which will cause fresh generic distinctions, and others will take their places in well-established genera: that named *Halmaturus irma*, and belonging to the kangaroos, is of singular beauty and delicacy, from the distribution of the white and black spots on its head and tail, and its slender form. It inhabits the banks of the Swan River.

*Roman Pontifical Vase discovered.*—The improvements now making in the Cemetery of St. Pancras, Chichester, have brought to light, within the last few days, a beautiful and perfect Roman Pontifical Vase, called a *Præfericulum*, being the second vessel of that kind lately discovered in the same place. This fine piece of pottery is in the possession of Mr. King. These curious vessels were used in Pagan funeral ceremonies, and contained the consecrated lustral water which was poured on the bones when burnt, in order to defend the ashes from the presence of evil spirits, or other contaminations.—*Hants Telegraph.*

Digitized by Google

*Great Western Railway.*—The subsiding of the Hanwell embankment, we are informed, was effectually stopped before the middle of November, by means of the culvert alluded to in a preceding number. A report had reached us from a very respectable friend, that this embankment had sunk five feet in one night. On our friend's giving us his author we immediately laid the report before the proper parties, and had an assurance of its never having sunk more than as many inches. Really men, and especially the servants of the Company, should be cautious how they propagate such wicked statements. We believe all parties connected with this great line are not a little annoyed at not being able to keep their word with the public as to the time of opening. As to ourselves, we rather think the delay will ultimately prove advantageous to the shareholders and works than otherwise.—*Railway Magazine.*

*The value of Labour.*—Both the main and hair springs of watches are made of steel first drawn into wire. In the former description of spring, the workman gives to the material its wonderful elasticity, by hammering it out upon an anvil; it is then grouud, hardened, coiled, and tempered, by blueing, as we see it. The manufacture of the latter article (the hair spring) has frequently been selected as an illustration of the extent to which the value of a material of small intrinsic worth may be raised by the application of industry and ingeniuty. "A pound of crude iron costs *one halfpenny;* it is converted into steel; that steel is made into watch-springs every one of which is sold *for half-a-guinea* and weighs only the tenth of a grain: after deducting for waste, these are, in the pound weight, 7000 grains; it affords, therefore, steel for 70,000 watch-springs, the value of which, at half-a-guinea each, is 35,000 *guineas!*"

*Iron Steam-Boat.*—An iron steam-boat, L'Egyptienne, was, some months past, built at this port for the Pacha of Egypt. It was contended at the time that it would be impossible to navigate the vessel by compass, as the material of which she was built would derange the magnet. L'Egyptienne, however, arrived safely and directly at Alexandria. The following is an extract from her log-book:—"During the voyage from Liverpool I did not find that the compass raised from the deck was affected by the iron about the vessel. The course was given to the steersman by the one on the binnacle, allowing the difference, and in two subsequent voyages to Candia and back I had not the least difficulty in navigating the vessel. On each voyage to Candia we had a strong gale from the N.W., against which we made headway at the rate of five knots an hour. —Donald Clarkson." It would appear that if the compass be completely surrounded by iron, and thus equally attracted in every direction, its polarity is no more affected than if no portion of that metal were in its vicinity. The result of the voyage of L'Egyptienne has set at rest the question of the possibility of attempting sea voyages in iron vessels.

*Red Colouring Matter in Salt Marshes.*—We some time ago noticed the red colouring matter which had been observed in the saline pits or marshes of the Mediterranean, and then ascribed it, as others did, to a little Branchiopoda, called *Artemia salina.* But M. Dunal has, he thinks, disproved this, and ascribes it to a small plant, a true Protococcus, to which he has given the name of Salimus. In other reservoirs M. Dunal found another plant of an orange red, which is a species of Hœmatococcus; and in a third place he found a species of the genus Protonema. M. Dunal, however, is of opinion, that the two former may prove to be the same plant in different stages of development. The colouring matter of the Hœmatococcus stains the hands in a lasting manner.—*Athenæum.*

*Stimulants of Great Men.*—It is interesting to notice the different articles which have been taken by eminent men, as stimulants to the mental faculties. It is interesting, as showing how diametrically opposite means may produce the same effect in various systems; and it is interesting, as showing how much the mind sympathizes with the body. Holler drank plentifully of cold water when he wished for great activity of the brain; Fox, for the same purpose, used brandy. The stimulants of Newton and Hobbes were the fumes of tobacco; those of Pope and Fontenelle, strong coffee. Dr. Johnson, at one period of his life, was a great wine drinker, but in the latter part of it, found strong tea a good substitute. Don Juan is said to have been written under the influence of gin and water; and it is reported that a certain legal lord, of great learning and talent, plies himself well with port wine when he wishes to shine. Pitt was a great drinker of wine; Sheridan, also, was fond of his bottle. Dr. Paris tells us, that when Mr. Dunning wished to make an extraordinary display of eloquence, he always put a blister on his chest a few hours before the time he was to speak, in order that it might irritate the brain by sympathy during his speech.

Digitized by Google

# THE CHEMIST.

## LEAD.

This metal is of such very common use, and is so often employed in domestic arrangements, that no individual at all acquainted with its nature and injurious effects when combined with oxygen, (as it almost continually is through its exposure to the atmosphere and other fluids containing this element) will be surprised at the extent of the ravages it makes upon the constitution. From our infancy we are fed upon substances diluted with water conveyed to us through leaden pipes, and often preserved in tanks and cisterns of the same metal; nay, milk, the general and proper source of nourishment for babes, is kept in leaden vessels. Animal food, also, may sometimes be seen in leaden trays. Sugar of lead (per acetate of lead) is sometimes used in the cooking of vegetables, as broccoli, cabbage, &c. Children's sweetmeats are dyed with the various oxides of lead, as red lead, &c.; and children's toys are painted with the same poisonous materials. But it is useless to multiply facts in support of this statement; it is only necessary to declare that it is the opinion of many learned physicians, that a great number of the diseases of the human frame, especially those terminating in apoplexy and paralysis, spring from this source; and this we may easily believe when we consider how early in life we are brought into contact with it.

### TESTS FOR THE DISCOVERY OF ITS PRESENCE.

1. A piece of zinc, introduced into the liquid suspected to contain this metal, will, if it be present, be covered with an arborescent deposition.

2. Chromate of Potass introduced will produce a beautiful yellow precipitate, which is a chromater of lead, or chrome yellow as called by the painters.

3. A stream of sulphuretted hydrogen (procured in the manner as described for the detection of arsenic) being forced in the liquid, will produce a dark brown precipitate.

### MERCURY.

The most common form in which this metallic poison comes under our notice, is as a per-muriate or corrosive sublimate; it need not be said that this is a most virulent poison; some of the tests for its discovery are the following:—

1. If a rod of brightly-polished iron be allowed to remain a short time in the solution, numerous minute globules of mercury will be found attached to it.

2. The same effect is produced on a stick of phosphorus.

3. The white of an egg, if dropped into the liquid, soon becomes thickened.

4. Hydriodate of potass will produce a brilliant scarlet colour.

## ON THE ELEMENTS.

### NO. III.

### CHLORINE, IODINE, &c.

Chlorine derives its name from its green colour. It was at first called oxymuriatic acid gas, from the mode of its preparation, but is always now considered as an element.

Chlorine has a suffocating pungent odour, acts with great energy on the metals and other inflammable bodies,—igniting them. It is very destructive to animal and vegetable life; it discharges and completely destroys the vegetable colours, and speedily dissipates infectious and putressent odours.

All experiments with this gas ought to be conducted in such a manner that the fumes may be carried away. Ammonia will give relief, should a small quantity have been taken into the lungs with the air.

Preparation.—Heat, cautiously, in a retort, three ounces of aqueous muriatic acid with one ounce of buroxide of manganese; chlorine is evolved, which may be collected in the pneumatic trough, the water of which must be heated to about 100°. Cold water absorbs chlorine.

Chlorine enters into many combinations with the metals and alkalies; they are called chlorates and chlorides.

Muriatic acid, a compound of chlorine and hydrogen, is made by decomposing chloride of sodium (common salt) by sulphuric acid; muriatic acid gas is disengaged, and, combining with the water in the receiver, is the aqueous muriatic acid, or spirit of salt of the shops.

Iodine, bromine, and fluorine, are similar in their properties to chlorine, though not so important. The two former exist in sea water, from which they are obtained by a number of complicated processes. The latter exists in the mineral known as fluor spar, from which it may be obtained by decomposing with sulphuric or nitric acid. It has the singular property of corroding glass or any other compound of silica; it must, therefore be kept and made in metallic vessels. Lead is generally used.

Apollo Chemicus.

Digitized by Google

## INSTITUTIONS.

*Tower-street Mutual Instruction Society.*—The second Anniversary Supper of this Institution took place on Tuesday, January 9th, at Short's, Strand Hotel, when fifty of the members and friends sat down to supper. The cloth having been removed, and Mr. J. Robinson called to the chair, and Mr. J. Thome to the vice chair, the following toasts were drunk by the company; viz., "Female Education," "May knowledge be universally diffused," "The Press," "May our moral improvement keep pace with our scientific attainments," "Success to the Tower-street Mutual Instruction Society," "The steam engine, Watt, Hornblower, Hancock, Bensley, and all improvers and appliers of it to useful purposes" During the evening many excellent speeches were delivered, and several songs and glees sung by the harmonic portion of the Society in a manner which met with the marked approbation of the company. The healths of the chairman (founder) and vice chairman were then drunk. Several ladies were present.—A Prospectus of the Society will be found in No. 61 of this Magazine.

Jan. 22, Mr. Thorne, on Metallurgy.

*Southwark Literary Society.*—Jan. 24, T. Adams, on Music—Course concluded.

*London High School*, Tavistock-square.—Monday, Jan. 22nd, 1838, at a quarter to seven, Professor Dewhurst on Astronomy—Concluding Lecture.

*North London Grammar School*, Goswell-road.—On Tuesday, Jan. 23rd, Friday, Jan. 26th, and Monday, Jan. 29th, Professor Dewhurst on Astronomy.

We feel great pleasure in being able to inform mechanics residing in the neighbourhood of the Curtain-road, Old-street-road, Shoreditch, and parts adjacent, that a Day School for instruction in the Pestalozzian System of Object Teaching, will be opened on Monday, the 15th instant, at No. 25, Curtain-road, Shoreditch. Terms as follows:—For children under eight years, 6d. per week; ditto under twelve years, 9d. per week; with French and Latin, 1s. per week. The Tuition, besides the ordinary course of Reading, Writing, Spelling, and Arithmetic, will consist of Grammar, Composition, Logic, Geometry, Astronomy, Geology, Geography, &c. There is also an Evening Class for Females. The Carstarian System of Penmanship is also taught at the establishment.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—I beg to ask, through the medium of your useful journal, how the bottle that "C. P. Thomas" speaks of was cast; was it cut in half or not?

C. C. W.

SIR,—Will you favour me by inserting the following queries:—Where is the steepest ascent on a public road within ten miles round London? And what is the inclination of the same? H. D.

SIR,—Will some of your correspondents oblige me with information respecting the following queries:—What is the rule for cutting the gores of balloons?—How can I prepare infusions which generate animalculæ, suitable for the microscope?—From what is the naptha prepared which is now used in lamps?

F. E. L.

[If "F. E. L. refers to our back numbers, he will find answers to his other queries.]

SIR,—Can any of your readers inform me how I can transfer engravings upon glass, so that they may be shown in a magic lantern? I have tried several methods, but I have found none which left the engraving sufficiently transparent. J. BATEMAN.

Is there any means of removing the brown stain on the hands, occasioned by picking new walnuts? I have tried the strongest acids and alkalies, but without success. J. GORDRED.

SIR,—Having occasion to use the solution of India-rubber with my hands sometimes, I should be obliged if any of your numerous Correspondents could inform me of the best method of completely extracting the same from the pores of the skin, as I find, after rubbing it off dry, and then washing them, they appear quite black and dirty, which is a great detriment to me in my regular business. C. W.

SIR,—I should feel extremely obliged to you, or any of your kind readers, if I could be informed how to separate oil from water; supposing I have but a small quantity of oil, and it only floats about the top of the water in pieces the size of a sixpence.

AN INGENIOUS WATCHMAKER.

SIR,—Your excellently-conducted publication having afforded me much information on various subjects, I take the opportunity now afforded of expressing my unqualified approbation of the manner in which it is conducted. Also, through its medium, I shall be happy to learn in what manner sugar, after being boiled, can be preserved in a brittle state. Hitherto I have found that damp weather affects it so much, that it melts, and is of the consistence of treacle.

A SUBSCRIBER.

SIR,—I have a pulley with three grooves round it, of three, four-and-a-half, and six inches diameter; I have also a wheel with a groove round it, of twenty-four inches diameter; and I require two more grooves round it of such diameter, that they shall so correspond with the grooves in the pulley, that one band shall serve all the three. The centres are thirty-four inches apart. If your scientific Correspondent "Q. E. D.," or any other, would give the two diameters of the required grooves, and the method of finding them, it would greatly oblige, Sir, your obedient servant, J. S. H.

SIR,—Can any of your ingenious Correspondents inform me what is the best method of dissolving gun copal in spirits of wine, in order to produce French polish? A. W.

## ANSWERS TO QUERIES.

SIR,—Mr. Saull, of Aldersgate-street, possesses a superior museum, filled with fine geological specimens, and which is opened to the public every Thursday morning at eleven o'clock, when Mr. Saull delivers a Lecture on Geology.

A description of the Electro-magnetic Engine will appear in the pages of this Magazine. C. D. T.

## TO CORRESPONDENTS.

"A Navigator." *We have not had an opportunity of seeing Mr. Wood's Thermometers, but, from what we have heard, they are superior to all others.*

"Thomas B.'s" *opinion coincides with ours in the main points.*

"C. C. W." *We believe not.*

"Thames" *has not sent us the Table he refers to in his third paper on Steam.*

*We shall be happy to insert the communication of* "Erasmus," *if suited to our columns.*

"A Watchmaker" *can purchase our first volume at any booksellers. The price is 4s. 6d.*

"A Subscriber" *has rather* alarmed *us. He has given us the alternative either of paying five or six pounds to illustrate his visionary ideas, or lose the weekly subscription of a penny.*

"Z." *No. 15* *ains a description of Plummer's Fire Staircase.*

*We cannot give* "A Subscribe" *any further information, for the present, of the Tubus Calefactus. The discovery, in our opinion, is more likely to to have been accidental, than the effect of study.*

ERRATUM.—Q. E. D. on Perpetual Motion, No. 62, page 170, for "electricity," read *elasticity*—No. 63, page 184, col. 2, line 39, for "Lones" read *bones.*

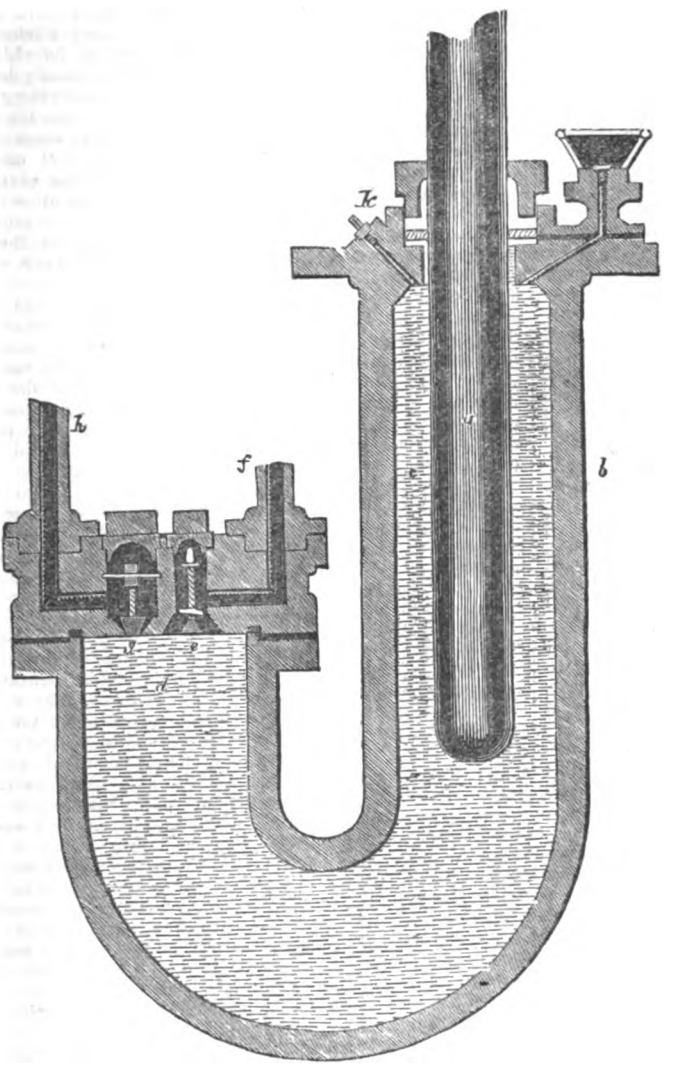
London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LXVI.] SATURDAY, JANUARY 27, 1838. [Vol. II.


PORTABLE GAS PUMP.





Vol. II.—No. LXVI.

Holloway Press: D. A. Doudney.



Digitized by Google

## PORTABLE GAS PUMP.

*To the Editor of the Penny Mechanic.*

SIR,—Having read the application of your correspondent, I send you the following drawing and description of the pump used by the Portable Gas Works. The figure represents a vertical section of one of the pumps, with the plunger, *a*, at its lowest immersion, or down-stroke, as it is called. At this moment of time every part of the syphon is completely filled with the fluid it contains, to the entire exclusion of atmospheric air; the deeply-shadowed part, *c*, being water, and the lighter tint quicksilver. It will therefore be easily conceived, that when the plunger is withdrawn by the up-stroke, an empty space, or vacuum, equal to the cubic admeasurement of the plunger, will be left in the syphon; and as mercury is a much heavier body than water, the latter is pushed up by the former, and follows the plunger as it ascends. The mercury consequently sinks below its present level, which causes the suction pipe, *e*, to open, and to let in a volume of gas at the ordinary pressure, which flows from a gasometer, or gas-holder, through the pipe *f*. At the down stroke of the plunger the gas is then compressed, and forced through the discharge valve (which opens only outward) into the pipe *h*, which leads to a strong recipient, into which the gas is condensed. The action of the pumps being continued, the compression of the gas is effected to whatever degree may be required, provided the power of the gas-engine or other first mover be adequate. In the Portable Gas Works above-mentioned, there were recently nine pumps in operation, worked by a ten-horse engine. The quicksilver and water are poured into the syphon, by means of the basin and perforation, *a i*, the aperture at *k* being opened to allow air to escape: the aperture, *k*, is next made perfectly tight, by a plug which is screwed into the orifice; during which time water is continually poured in at *i* to expel the air completely, and fill up every crevice with that fluid; another plug is screwed into the orifice at *i*, with the water above it. After this, the first downstroke of the plunger expels the atmospheric air on the surface of the mercury in the short leg of the syphon, and the pump is then ready to perform the office of alternately drawing in the gas from the gas-holder, and compressing it into the portable lamps. The gas sent out by the Company is compressed into 1-30th of its original volume.

I am, Sir, your humble servant,

A. BENDIXEN.

## ON LEVELLING.

NO. II.

*To the Editor of the Penny Mechanic.*

HAVING in my last briefly noticed the principal elementary definitions, and the nature of the instruments with sundry hints, I beg to continue the subject in the present. In taking any series of levels the first thing to be determined is the starting point, which is always determined by the nature of the subject for which the levels are required; but it mostly depends upon local circumstances, since the ground cannot be moved to accommodate the levels, the levels must be made to accommodate the ground. In all practical cases of levelling, the height of some particular point is required above some other point; for instance the height of the summit of a hill above the surface of a neighbouring canal, or the difference of levels of two towns, as for forming railroads and canals which must always be determined before any determinate idea of the expense of the canal or road, &c. can be had; as also all the intermediate points between these two towns, that presents any particular variation from the general line of surface of the country through which the line passes; and it is obvious that by determining a sufficient number of these different intermediate heights, we are enabled to form a complete profile outline of the surface, shewing every rise or fall of consequence, which is the essential requisite of practical levelling; from thence to compute the cost and quantity of earth necessary to be removed from a cutting, &c. to form an embankment, and *vice versa*. And it is further plain that to determine these different heights there must be some general standard line of reference, otherwise we should have a series of heights without being able to determine anything from them, and this standard line of reference must be perfectly horozontal, as will be subsequently proved, so that referring any observed height to this line, and another observed height we are enabled to ascertain the true difference of level required. And let what will be the point of starting, as the surface or bottom of a canal, &c. the levelling staff must always be placed perpendicularly on that point, and the levelling instrument itself in any convenient situation near the line of direction, and there perfectly set and adjusted; then turning the instrument towards the staff the height must be taken, and registered in the field-book, this sight is therefore the "first back" sight, and as such must be entered; then the staff must be moved

Digitized by Google

from the first point to any other convenient or necessary point in the line of chainage, and an observation taken at this point, from the *same position* of the levelling *instrument*, and this constitutes the second or the sight; and as such must be registered directly opposite the previous observation, having a column between them for the insertion of the length of surface between these two observed points, so that by having the distance of every consecutive observation, we can readily form a corresponding section, and obviously the difference of these two observed heights, will be the true difference of level, corresponding to the distance between them; then the staff remaining in the last position, the *levelling instrument* is removed to any other convenient spot, and adjusted as before; then observing the height on the staff, this will be the second "back" sight, and must be put under the other. Now, again, let the staff be moved to any other convenient distance in the line of chainage, and an observation taken, this height will be the second "fore" sight, and must be put under the other, and the distance of the two points entered between them as before, and these alternate "back and fore" sights being continued to the end of the line, will give all the levels required; which being reduced by methods which will be subsequently given, we can form a perfect section from the result. And we may here observe, that whenever the instrument is moved, and the new position determined on, it is quite immaterial whether the position be in the exact line of direction or on either side of it, provided the distance is not very great, as it must be plain that whatever difference it makes to one observation, it does to the other, or if one is increased, the other is decreased in the same ratio, so that they modify each other, and no error can arise from this, by reason of their mutual correction; but whatever latitude may be given to the *instrument*, the *staff* must invariably be placed in the direction of the chainage, otherwise considerable error would arise. And it is plain that the distance between the extreme points is determined at the same time the levels are, since the sum of the distances between each of the observed points must be equal to the total distance; and the distance is measured in constant progression the same as in surveying. The distances and different positions of the staff and instrument, so often cited, must as a consequence be regulated by the nature of the ground; for if the ground is very irregular and varies rapidly, the staff cannot be placed very far from the instrument, for the observer would not be able to see it, from the fact of its being considerably above or below the instrument as the case may be; therefore, under these circumstances, the shorter the sight the better; but if the surface is regular, long distances may be taken at pleasure, without entailing any error. In ordinary levelling, a distance of one chain will be about the common average; but this must be varied according to circumstances; in many instances they must be as short as ten or twelve links, which renders the levelling very tedious and operose, from having to move and adjust the level, as it must be at every movement perfectly adjusted, otherwise the result would be totally erroneous. Some very frequently take short lines, at right angles to the main line, in any particular points, from which evidently they can form a complete *model* of the surface, shewing distinctly every variation of surface; and this is a very useful way of levelling and laying down a line of country, especially for a canal, as from these they are enabled to judge of the necessity of locks, &c. for the regulation of the egress and ingress of any tributary streams. In levelling practically there is not any necessity for taking into account any variations or irregularities in the surface made artificially, as little hillocks, or ditches, watercourses, &c, unless they may be very considerable, as they will not interfere with the general surface of the ground, which is all that is required, and they may be readily filled up or levelled with the shovel at little cost; whence by neglecting such as these, no error can be said to arise; but all hedges and embankments, or cuttings of considerable size, must be taken into account and accurately determined, as they are of consequence. And observations of any particular objects, as houses, trees, ponds, &c. may be noted in the margin of the book, indeed this is essentially necessary, and is always attended to in practice, as it assists, and is of use in making out the line after being levelled; in short, with a little extra trouble in this respect, we can both take a level and survey at the same time.

TYRO LOCK.

## ON THE NATURE AND PROPERTIES OF STEAM.

### NO. III.

### VIS VAPORIS.

LIKE air and other elastic fluids, steam loses its elastic force and pressure directly

Digitized by Google

in proportion as it is allowed to expand. Thus if allowed to expand twice or three times its volume, it will only have half or one-third of its original pressure, supposing its temperature preserved. From this it follows that the expansion of steam is exactly proportioned to its force in atmospheres as in preceding article. And the following table is an exibition of the results of this law at different temperatures, with the corresponding pressures and expansions. The first column contains the temperature of Fah., the second the pressure in pounds per square inch on the safety-valve, and the third the number of times its volume to which the steam would expand, still maintaining an elasticity equal to the atmosphere.

| Temperature. | Pressure. | Expansion. |
|---|---|---|
| Degrees. | Pounds. | Time. |
| 212·00 | 0 | 1 |
| 250·52 | 15 | 2 |
| 275·18 | 30 | 3 |
| 293·72 | 45 | 4 |
| 308·84 | 60 | 5 |
| 320·36 | 75 | 6 |
| 331·70 | 90 | 7 |
| 341·96 | 105 | 8 |
| 350·78 | 120 | 9 |
| 358·88 | 135 | 10 |
| 367·34 | 150 | 11 |
| 374·00 | 165 | 12 |

A table similar to the foregoing can be constructed from the experiments of Messrs. Dalton and Taylor, before referred to, viz.—*To determine the pressure on the safety-valve, subtract thirty from the elastic force in inches of mercury, and half the remainder will be the required pressure in lbs., or what is the same thing, subtract unity from the elastic force in atmospheres, and multiply the remainder by fifteen, and the product will be the pressure in pounds per square inch.* These results will perhaps be more correct than those in the table. In Brunton's Compendium, a most excellent mechanical work, there is a larger, and I believe, correct table. Mr. Tredgolds rule for determining the volume of a cubic foot of water converted into steam of a given elastic force and temperature, is as follows:—*Multiply the sum of the given temperature in degrees, and* 459 by 76·5, *and divide the product by the force of the steam in inches of mercury: and the quotient will be the number of cubic feet occupied by the steam of one cubic foot of water.* From this the weight of a cubic foot of steam and its specific gravity at different temperatures may easily be obtained by proportion. Thus to find the volume of a cubic foot of water, when converted into steam of atmospheric pressure, (at 30°, inches, and temperature 212) we have $212 + 459 = 671$, and $671 \times 76{\cdot}5 = 51331{\cdot}5$, and $51331{\cdot}6 \div 30 = 1711$ cubic feet.

C. D. Thomas.

## STEAM-ENGINE CRANKS.

The supposition on which T. M.'s former question, and my former answer was founded, was that the power of an engine was only effective during one-third of its revolution. Now it appears to me that there is no *gain* in using two engines as regards power, but only as regards regularity where a fly could not well be used; but T. M., by his ingenious plan, goes to shew that the *effective power* of a pair of fifty-horse engines' nominal power, one hundred, is only fifty. Now on the supposition that there is no gain in power, but only in regularity in double engines, this would give one-half as the effective power, instead of one-third as on former supposition. I see not how this could be well settled, except by experiment or long and tedious calculation. Perhaps T. M. in his next will state whether he thinks that there is any gain in the use of double engines, other than that of regularity; as also whether he has thought of any means to cause the full power of the engine to be exerted throughout the stroke. For my own part I am inclined to think the crank the best method of changing a reciprocal motion into a rotary one, yet discovered, or to be discovered, I was about to say; but therein T. M. would not perhaps agree. The table extracted by T. M. from that *excellent* work Brunton's Compendium, bears directly upon this subject, as it shews the power exerted upon the crank by the piston, in different parts of the stroke; and here T. M. asks for an explanation of the decimals used therein. Decimals, or decimal fractions, are the numerations of fractions, having a certain known denominator, which denominator consists of as many cyphers as there are *places* or figures in the decimal with the integer 1 prefixed, so that ·5 signifies $\frac{5}{10} = \frac{1}{2}$ and ·05 $= \frac{5}{100} = \frac{1}{20}$ and 1·25 .. 1 and $\frac{25}{100} = 1$ and $\frac{1}{4}$, the decimals commence after the full-stop as in last example.

Digitized by Google

From this the table with the explanations thereto affixed will be easily understood. Supposing the engine to be starting, and at the dead centre—no portion of the piston will then have descended, ∴ marked 0 in table, and the angle formed by the connecting rod and the crank = 180°, so marked in table. Effective length of lever ... 0, and portion of ½ revolution of fly-wheel .. 0, both so marked in table. But when, as in the second line, the engine has made ·05 or $\frac{1}{20}$ part of the stroke, the angle is then reduced to 151½°, and the effective length of lever then becomes of value, viz. ·46 = $\frac{46}{100}$ and the fly-wheel has performed ·128 = $\frac{128}{1000}$ of its semi revolutions, and so on throughout all the other cases. And as the stroke proceeds its value becomes greater, as seen by table, and the angle of the rod and crank decreases, and the effective length of the lever increases to 90°, the right angle, and then again decreases as the stroke approaches the bottom dead centre, and the valve of the portion of fly-wheel turned, also increases.

The publication of such tables as these, and they abound in the many standard mechanical works in the English language, would be of great use to the readers of the Penny Mechanic; and I should recommend all those correspondents who write on subjects which admit of it, to illustrate them by such tables; as they, like wood-cuts, tend to make plain, simple and understandable, what would otherwise appear intricate, involved, and incomprehensible.

C. D. Thomas.

## ROYAL ASTRONOMICAL SOCIETY.

*On the Repetition of the Cavendish Experiment, for determining the Mean Density of the Earth.* By the President.

Dec. 8, 1837.—The Council has long had it in contemplation to repeat the celebrated and interested experiment of the late Mr. Cavendish, for determining the mean density of the earth, and a committee was appointed more than two years ago to consider of its practicability. The object is now in a fair way of being accomplished. Her Majesty's government having been pleased to grant the sum of 500*l.* towards defraying the required expenses. The apparatus is, at this moment, in the course of being erected, at Mr. Baily's house, and, as soon as it is completed, the experiments will be commenced. During the time, however, that the subject has been in agitation in this country, it appears that the same experiment has been undertaken by M. F. Reich, Psofessor of Natural Philosophy in the *Académie des Mines*, at Freyburg, in Saxony, who appears to have followed the same method as that of Cavendish. The apparatus was erected in a large room under the buildings of the *Académie*, the windows of which were carefully closed up, and other precautions taken to preserve a uniform temperature. To avoid currents of air, the oscillations were observed by means of a telescope fixed outside the door of the room in which the apparatus was placed, and directed on a mirror attached to the extremity of the arm, and illuminated by a lamp, also placed outside the room. The masses, whose attraction was to be measured, were two spheres of lead, weighing 45 killogrammes, or 695,061 grains. They were suspended by brass rods to a beam, moveable about a vertical axis. It was found, however, most convenient, to use only one of the spheres. Nearly two years were consumed in the necessary preparations; but when completed, M. Reich was enabled to perform the experiments during the three months of June, July, and August, 1837. Each observation required the determination of three quantities:—the distance of the centres of the large and small spheres, the time of the oscillations, and the deviation of the arm of the balance. The distance varied from 6·62 to 7·49 inches; the duration of the oscillations, from 6m 41s, to 6m 50s; and the deviation from 2·36 to ·315 of an inch. The number of observations was 57. The mean of the whole gives the density equal to 5.44, a result which is almost identical with that of Cavendish. M. Reich, also, used for the attracting mass a sphere of cast iron, of the same diameter as the leaden one, and weighing 50 killogrammes, or 463,373 grains. Five observations with this sphere gave the density =5·43. The only innovations on the method of Cavendish, appear to have consisted in using only one of the great spheres in the same experiment, and in the mode of observing the deviation of the arm of the balance. The arm itself appears to have been nearly of the same length as that used by Cavendish, but we are not informed of its weight, nor of the weight of the small balls. The large spheres, however, were much inferior to those of Cavendish, their diameters being only 7⅞ inches, and weight less than 2-7ths of those used by Cavendish. The employment of the cast-iron sphere is a new fea-

Digitized by Google

ture in the experiment, but it does not appear that the small balls were changed.

Mr. Baily concluded with remarking that, though these experiments are, on the whole, confirmatory of the general result obtained by Mr. Cavendish, they do not interfere with the plan the council of the Society had in contemplation, which was not merely to repeat the original experiment in a precisely similar manner, but also to extend the investigation by varying the magnitude and substance of the attracting masses, by trying their effect under considerable differences of temperature, and by other variations that may be suggested during the progress of the inquiry. —*Athenæum.*

## METEOROLOGICAL SOCIETY.

Mechanic's Institution, Southampton-buildings, Holborn, Jan. 9th, 1838; Charles Shearman, Esq., F.R.A.S., Treasurer, in the Chair.

A VERY interesting paper was read by the Secretary from Lieut. Geo. Grey, Associate Member of the Society, who is gone out in charge of the Australian Expedition of Exploration. This paper chiefly related to the meteorology of the island of Teneriffe, which, says the writer "is of volcanic origin; and as its famed peak is at the present moment, and has been since the island has been known to Europeans, in the state of a solfutara, I entertained a hope, that if a series of observations had been made, they might possibly throw some light upon the influence that volcanic action exercises upon atmospheric phenomena."

Lieut. Grey was fortunate enough to discover that a series of observations had been made by the late Dr. Savignon during a period of eight years (from 1811 to 1818 inclusive) without the intermission of a single day.

In order to form some comparative estimate of these observations, Lieut. Grey immediately ordered two sets of observations to be made on board H.M. ship *Beagle*, then lying at Santa Cruz, a quarter of a mile from the shore. One set was made in the cabin of Capt. Stirckham, R.N., and the other upon the quarter deck in the shade. From these two sets of observations, made during a space of five days, the mean result was found to be nearly 76° Far. These observations were made in July, and in an unusually warm season, still they serve rather to corroborate Dr. Savignon's observations, than to annul them.

Dr. Savignon's observations were made at the town of Luguno, three miles from the shore, and 1800 feet above the level of the sea, and his observations produce a mean of 68¾° Far. for the month of July; which difference of only about 7° will be easily accounted for, when we take into consideration Lieut. Grey's observations extending to a period of fifty days, and at the level of the sea, while Dr. Savignon's extend through a period of eight years, and at an elevation of 1800 feet. The mean annual temperature of the island for eight years, is nearly 63° Far. The quantity of rain which fell in the island of Teneriffe in 1812 was 19.33 inches, of which quantity 5.24 inches fell in the month of January, In 1813, the quantity of rain was 25·22 inches.

The Canary Islands are frequently visited by violent tempests; the following was extracted from Dr. Savignon's MSS.: "In 1826, in the night of the 7th and 8th of November, this island was visited by a tempest of wind and rain, which did much damage to all the Canary Islands." In the eight towns of Teneriffe, there were 311 houses destroyed, and 114 houses ruined; 243 persons killed, and 104 animals destroyed. From this brief statement, some conception may be formed of the fury with which these storms sometimes rage. The meeting then adjourned to the second Tuesday in February.

## MECHANICS' LIBRARY.

*The Millwrights' and Engineers' Pocket Director.* By John Bennett, Engineer, &c. John Bennett, Three-Tun's-passage, Paternoster-row.

WE have always had such a high opinion of Adcock's Engineers' Pocket Book, that we thought there was no room for any other publication of the kind. The volume before us has, however, caused us to think otherwise. The author says he has partly compiled it from the "Artificers' Complete Lexicon," at the request of many respectable millwrights and engineers. The geometrical problems in the introduction he claims, as being purely original. To these problems we beg particularly to call the attention of apprentices and young journeymen; and we are sure the old practitioner will find much useful information embodied in the work. It contains an alphabetical list of the principal engineers, &c.; the prices also of every article in the trade, from the sixty-horse engine, valued at 3600*l.* down to the threepenny file; with numerous other particulars.

Digitized by Google

# THE CHEMIST.

## ON THE ELEMENTS.

NO. IV.

### CARBON AND BORON.

CARBON exists in many different forms; the following are some of the principal:—

1st. The diamond, pure carbon.
2nd. The charcoal of wood.
3rd. Coke, made from coal.
4th. Coal itself.
5th. Plumbago (I 1+C 9).
6th. Jet (variety of coal) petroleum, naptha, mineral tar, &c.

It is also a compound of all vegetables, wax, oils, gums, and resins.

Carbonic acid, the compound of carbon best known, is always formed when carbon is supplied with oxygen; it is also evolved during fermentation by the decomposition of animal and vegetable matter, and during respiration. Carbonic acid gas was the first elastic fluid distinguished from air; its acid nature was first pointed out in 1755, by Dr. Black, of Edinburgh.

Carbonic acid extinguishes flame, has a sharp acid taste, and is fatal to life. Its specific gravity is to that of hydrogen as 20·7 to 1; 100 cubic inches weigh 7 grains; water absorbs its own bulk of this gas.

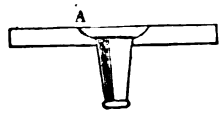
*Preparation.*—Put some chalk or marble in a retort, and pour over it diluted muriatic acid, the carbonic acid is evolved, and muriate of lime is left in the retort, a salt much used for depriving gases of their moisture; it is fused (now chloride of calcium), and in this state has given affinity for water.

Boron exists in boracic acid. It is a dark infusible powder; its only known compositions are boracic acid and borax (borate of soda).

## ELECTRICAL STOOL.

*To the Editor of the Penny Mechanic.*

IN No. 55 of your Magazine, there is a paper describing an electrical stool; I now ask permission to send one of my own plan, which, if not better, is, I trust, as good; therefore, if you will favour me by inserting this letter, you will oblige me, and allow your correspondents to judge for themselves as to which is the best, the least trouble, and expense; not that I in any way speak against your Correspondent's, on the contrary, I think it very ingenious; but the way in which mine is made, is to take a piece of wood of any size most convenient to the maker, then get two other pieces as long as the width of the stool, three or three-and-a half inches wide, and about one inch and a half thick; bore a hole in each end of these pieces big enough to let the neck of a bottle to fit tight, leaving a part of the body of the bottle on. Let the body, A, flush down into




the pieces, then screw on the pieces of wood with the body of the bottle next the slab of the stool; the stool will then be made. My object in screwing on the piece, is in case one of the legs should by any accident be broken, for then the screw is only to be taken out, and a fresh neck put in; therefore it wants no cement, as in the case with your Correspondent. I, however, leave off here to let the rest be seen by others who wish to make them. The necks of bottles may be got at any bottle merchants or wine vaults for little or nothing. Yours truly, Z. WIGO.

## ELECTRICITY.

*To the Editor of the* PENNY MECHANIC.

SIR,—Having seen in your valuable little work several experiments in electricity, will you allow me to add one to their number. A piece of cotton-wool saturated with sulphuric æther, and fixed in the prime conductor, will ignite by drawing a spark from it, either with the knuckle or discharging rod, and while burning, if the machine be kept in action, a succession of sparks may be taken from the flame by the ball of the discharging rod; but if the ball be taken off, and a point be presented, the flame will not only be singularly repelled, but almost instantly extinguished. The same effect may be produced by first presenting the knuckle, and then pointing the finger. I have frequently amused myself with the experiment, and have always found the wool ignite soonest by putting it in the hole on the conductor, so as to be even, or lower than the surface.

*Brighton.* ELECTRON, JUN.

*Soft Metal.*—Bismuth tin and regulus of antimony, of each a pound, melted together, used for taking impressions of medals or coins. J. R. W.

Digitized by Google

### AN ELECTROPHORUS.

The diagram below is the representaiion of a simple electrical machine, about twenty sparks from the upper conductor of which is sufficiet to charge a small Leyden phial.

1. Glass handle. 2. Disc of Brass. 3 Cake of resin.

A .B. Y. Z.

*The Poor Man's Barometer.*—Both the convolvolus and the pimpernel (anagallis) fold up their leaves on the approach of wet weather. The latter is called the poor man's weather-glass. In the same manner the different species of trefoil contract their leaves at the approach of a storm, and they have been named the husbandman's barometer. Chickweed is another plant which answers the same purpose. When the flower expands boldly and fully, no rain will happen for four hours or upwards: if it continues in that open state, no rain will disturb the summer's day. When it half conceals its miniature flower, the day is generally showery; but if it entirely shuts up, or veils the white flower with its green mantle, let the traveller put on his great coat, and the ploughman with his beasts of draught expect rest from their labour.

*Free Admission of the Public to Works of Art.*—A correspondence has taken place between Lord John Russell and those persons who have control over our great national buildings and collections of works of art, such as Westminster Abbey, St. Pauls, the Royal Academy, &c.; and the result is, that St. Pauls is to be opened to the public, free of expense, every day, from nine till eleven o'clock in the morning, and from three till four in the afternoon. The public are also to have the benefit of a great reduction in the admission fee to the Tower. The fee is to be reduced from three shillings to one. It appears also that the authorities of Westminster Abbey and the Royal Academy have refused to accede.

## INSTITUTIONS.

*Tower-street Mutual Instruction Society.*—Jan. 29, Mr. Thomas, on the Nature and Properties of Steam.

*Southwark Literary Society.*—Jan. 31, T. Adams, on Music—Course concluded.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Can any of your Correspondents inform me whether there is anything that will attract silver in the same manner as the load-stone attracts steel?

J. WHEELER.

SIR,—Having tried the first part of "A. B. Y. Z's" answer to "A Young Mechanic," in No. 62, of producing a plant from mustard seed, by electricity, and failed in the attempt, if he will explain it more fully he will much oblige A Subscriber. R. W.

SIR,—I should feel obliged if any of your Correspondents would answer the following queries:—1. I have a fly-wheel 6 feet in diameter, weighing about 350 lbs. working so much machinery; could a man turn one 12 foot diameter, of the same weight as the former, with double the machinery? If so, could he do it with the same ease?—2. What is strictly meant by a lever wheel?

## ANSWERS TO QUERIES.

SIR,—For the information of your Correspondent, "C. C. W." I subjoin the following experiments with phosphorus:—Put a little solution of Potash into a small retort, with a small piece of potash of the same strength as that in the retort, and placed in a saucer; heat the retort over a lamp; when it boils, bubbles of phosphuretted hydrogen gas will arise, take fire, and detonate as they escape into the air; but this experiment must be made with proper caution.

A piece of phosphorus, the size of a pea, is to be put into a long glass phial, and boiling oil poured carefully over it, till the phial is one-third filled. The phial must be carefully corked, and when used should be unstopped a moment to admit the external air, and closed again. The empty space of the phial will then appear luminous, and give as much light as a dull ordinary lamp, and just sufficient to see the face of a watch. Each time that the light disappears, on removing the stopper it will instantly re-appear. In cold weather the bottle should be warmed in the hands before the stopper is removed. A phial thus prepared may be used every night for six months.

X. Y. Z.

## TO CORRESPONDENTS.

"A. Z.'s" *query is not suited to our columns; but we believe the play must first of all be received by the manager of the theatre: and if thought worthy of being performed, is revised and sent to the Chamberlain for his approval*

"A Subscriber's" *paper on a National System of Education is not approved of.*

"Z." *We have not heard what the lowest price for travelling on the Great Western Railway will be; but we are of the same opinion as our Correspondent, that the charge of 2s. for riding to Harrow on the Birminghum Railway is an exhorbitant one, and which entirely excludes the mechanic from the enjoyment of those advantages so much talked of in the House of Commons by members when endeavouring to get the Bills passed into laws.*

ERRATA.—In No. 64, page 189, on Hydrogen, for "acid from the water," read *oxygen* from the water. —In page 187, line 30 from bottom, for "companion" read *comparison*.

In No. 75, page 195, line 6 from bottom, for "fire." read *fore*,

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LXVII.] SATURDAY, FEBRUARY 3, 1838. [Vol. II.


### PLAN TO CHECK THE SPEED OF HORSES.

FIG. I.

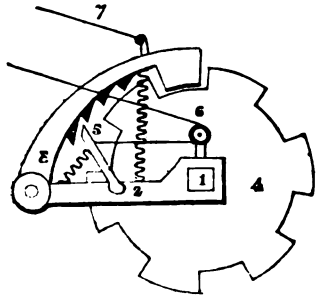
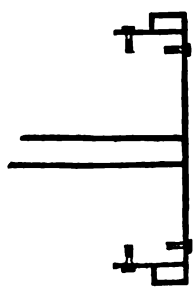



FIG. II.

FIG. III.






Holloway Press: D. A. Doudney.



Digitized by Google

## PLAN FOR LOCKING WHEELS OF CARRIAGES.

*To the Editor of the Penny Mechanic.*

Sir,—I have herewith sent you a plan for locking wheels of carriages, which will be found to be quite effective, without the trouble of dismounting, and also might be of great service in the event of horses running away, as the four wheels may be provided with it as well as one or two, each having separate lines, so that one may be used, or two, or four, at the option of the person on the box. Many accidents have happened by horses running away, and also by the poles breaking going down hill. In case of horses starting, there may soon be some hard work for them, with four wheels locked, as the driver would only have to pull the four lines leading to the wheels; and those lines may be so fixed that all the wheels could be locked with one pull. There is another advantage in this plan,—should any accident happen while ascending a hill, the wheels, when locked, cannot turn either way; by this means the carriage will be prevented running back. Or the driver may rest his horses by the same means without the trouble of blocking up the wheels behind. It will be seen by the description that the stock of the wheel will be much strengthened, and the whole of the work would last many years if properly made at first.

I am yours, &c.

T. L. M.

Description.—Fig. 1—1, the axletree; 2, a strong iron to fix on to the axletree; 3, a key, moving on a joint, at the end of No. 2; 4, an iron wheel, to fit on the stock of the coach-wheel, to be solid on the side next the carriage, as seen in fig. 2. Fig. 2—5, a ketch, to drop into the rack under 3; to keep the key up from the wheel it will be drawn towards the rack by the spring under it; when it is required to stop the carriage the ketch is to be drawn back by the line passing over a pulley at 6, the end being at the coach-box and passing under the carriage; 7, a line attached to the key 3, to release the key when required; when that is drawn up the ketch 5, will keep it so till removed. Fig. 3 represents the wheel, with the position of screws to fasten it to the stock. It will be seen that the iron wheel will not be required above two inches wider than the stock, the cogs about an inch and-a-half wide, and the plain part about the same, with screw-holes every two inches round.

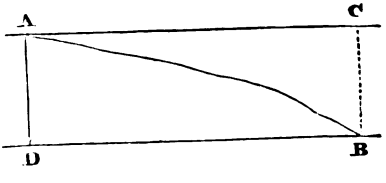
## ON LEVELLING.

NO. III.

Sir,—In continuing the subject, it is my intention to deliver each of the fundamental principles in the form of geometrical theorems, as by this means they will be both more clear and comprehensive, and much easier to be understood, besides the advantage of avoiding prolixity.

PROPOSITION I.

The difference of level of any two places, is as that length of a perpendicular, erected at one point, interrupted between the horizon of each point.



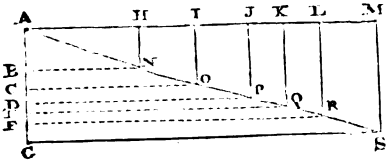

Let A B be the surface to be levelled, then D C is the horizon of the point B, and A C the horizon of the point A. The perpendicular height C B, intercepted between the two horizons, is manifestly the true difference of level required of A and B, &c.

By the term horizon, is to be understood the line A C perpendicular to the line A D at the point A, and similarly of the point B, the two lines A C, D B, being parallel to each other, and in the plane of the horizon. This term is to be considered as the abbreviation of "let the line A C be perpendicular to the line A D in the point A, and parallel to the horizon;" by thus considering it, we avoid a long and often recurring phrase, rendering the notation less circuitous and embarrassing. And, obviously, the difference of any two horizons is equal to the difference of level, since the lines A C and B D are the same as the visual ray from the instrument, intercepting between them the staff C B, the height of which, in this case, is the true difference of level as required.

PROPOSITION II.

The difference of level of any two distant points, intercepting between them any number of intermediate points, is equal to the sum of all those parts of a perpendicular, intercepted between the horizons of every intermediate point, erected at the extreme lower point.

Digitized by Google



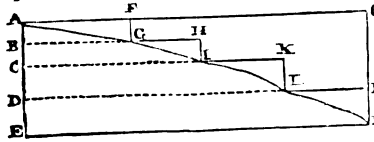

Let A, N, O, P, Q, R, S, be any number of points on the surface which is to be levelled, and A M, B N, C O, D P, E Q, F R, &c., be the respective horizons of these points, and H N, I O, J P, K Q, L R, M S, the observed height of the staff at the different points, consequently equal to the distance of each point from the first horizon A M, &c. Then A B, B C, C D, D E, &c, are distance of each horizon, or the difference of every two consecutive observations, and obviously the sum of their respective differences is equal to the whole line A G, which is equal to the line A S, which is the true difference of level of the two required points, as represented by the vertical line M S; therefore the *sum* of the consecutive differences is equal to the required difference of level.

These two theorems contain the first rule for reducing the observations which will be verbally expressed in a succeeding paper. This rule is that by which the difference of level of any two points is ascertained, when the observations are taken by the levelling frame, an instrument much used by the practical excavators. The extreme simplicity is its great recommendation, since nothing but addition and subtraction is necessary. It is very seldom used in reducing observations taken by the spirit level, as it does not always happen that each observation commences from the foot of the other, as will be explained in the next theorems. These two last theorems are the foundation of every succeeding rule, or I might rather say, that every other rule is but a particular case of the preceding.

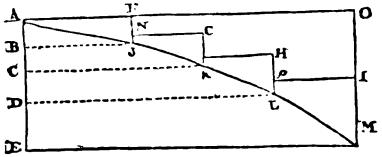
PROPOSITION III.

To find the difference of level of two extreme points. This question admits of two cases; viz.

*Case* 1.—When every back sight is equal to Zero=0.




Let A C I L N be the surface; A C I L N any points on it; A F, B G, C I, D L, E N=the horizons; A B, B C, C D, D E=the observed heights: F C, H I, K L, M N, &c.; then sum of A B+B C+C D+D E=sum of F C+H I+K L+M N=O N, which is equal to the true difference of level; therefore the sum of all the observed heights is equal to the difference of level of the two extreme points A and N.




*Case* 2.—When every back sight is some determined height, let A J K L M be any point on the surface; A F, B J, C K, D L, E M=the horizons; A, N J, C K, P L= observed back sights; F J, G K, B L, L M= observed fore sights; then A B, B C, C D, D E respectively equal to the differences of the fore and back sights; and obviously their sum is equal to A E=Q M, which is the true difference of level required; therefore the sum of the differences of the fore and back sights is equal to the true difference required, and the same applies to any of the intermediate points, &c. This last also applies to the reduction of any observations taken by the spirit level; in fact, it is the only rule used, all others being but so many extensions of it. The first case is that mostly used when the levels are taken by the levelling frame, and differs but little from Proposition 2.

Having thus given some of the most elementary theorems, I shall give a few additional observations when necessary.

The first proposition does not require any, the notes at the bottom being sufficient; and the same may be said of the second proposition, with the exception of remarking, that the sights in this case are what are called successive or simultaneous, from being all referred to back sight at A, as the standard, *and not* each full sight to a corresponding back sight.

The general rule of the second case of Proposition 3, may be thus expressed:—Subtract the first observation from the second, and third from the second, and so on continually, and the results are the difference of level of every two points, consequently their sum is the true difference; therefore, generally subtract each consecutive observation from the one preceding it, and the sum of their consecutive differences is the true difference required. To find the difference of any of the intermediate points, and the starting point,

Digitized by Google

add all the respective differeuces up to that point, and it will be the difference of level required to this point.

This is the rule commonly used for reducing the observation when taken by the spirit level; though it is plain, by the diagram, that it does not always happen that every back sight has a fore sight corresponding; in this case it becomes, by what has been already stated, a simultaneous sight. At other times the back or the sight may become=zero or 0; but in this case the process is precisely the same, since the difference is then equal to the whole observed altitude. To prove the truth of these rules, or to prove if an operation reduced by them is correct, we will give a rule for that purpose in a succeding Number.

I am, Sir, yours, &c.

TYRO LOCK.

## ON THE NATURE AND PROPERTIES OF STEAM.

NO. IV.

VIS VAPORIS.

THAT remarkable fact, indubitably established by experiment, that the sum of the latent and sensible heats of steam is a constant quantity, leads to many most valuable practical results; viz. 1st, that the same quantity of heat is necessary to convert a given weight of water into steam, at whatever temperature, or under whatever pressure, the water may be boiled; 2ndly, that in the steam engine equal weights of high and low-pressure steam are produced by the same consumption of fuel; 3rdly, that generally the consumption of fuel is proportional to the quantity of water converted into steam, whatever be the pressure of the steam.

It may likewise be remarked, that the variation of the density or specific gravity of steam is only strictly proportional to its pressure or elasticity, and no part of steam can be reduced to the liquid state by mechanical force or compression alone, without diminishing the sum of the latent and sensible heats. It has been accurately ascertained, that the latent heat of steam generated under the pressure of the atmosphere, is 1000°, its sensible heat being 212°; their sum, 1212° being a constant quantity for all the temperatures and pressures, so that between 32° and 1212°, the sum of the latent and sensible heats is 1180°, as under the ordinary pressure of the atmosphere, the first 180° would raise water at 32° to 212°, the boiling point, and the next 1000° would convert the water into steam; but as the thermometer does not indicate this addition of heat, it is called *latent*; so that *to find the latent heat, subtract its sensible heat in degrees of Fah. from* 1212, *and the remainder will be its latent heat.* Thus the latent heat of steam at 500° is 712°,

From the preceding principle, it will be easy to find the heat requisite to convert water of any given temperature into vapour or steam of any required temperature, thus:—*Add* 1000° *to the temperature of the steam, and from the sum subtract the temperature of the water, the remainder will be the heat of the conversion required.* Thus the heat required to convert water at 52° into steam at 220°, general low-pressure temperature is 1000+220—52=1168°.

In Tredgold's work are tables showing the application of the principles and rules above described.

C. D. THOMAS.

## WARMING HOUSES.

*To the Editor of the Penny Mechanic.*

SIR,—Will you have the goodness, if you should so far think them worthy of public attention, to insert in the Penny Mechanic the following suggestions, for the more advantageous application of artificial heat in dwelling-houses? In the first place, I would propose to obtain the cheerful appearance of an exposed fire-place, as usual, without the inconvenience of a draft of cold air coming from the opposite side of the room to feed it, by admitting the necessary supply of that essential commodity through a tube that should open under the grate, either at the back, bottom, or sides, or in the hearth under the fender: it might, at its other end, communicate with the external atmosphere, or with some other room that wanted ventilating (not heating), or with some cold corner of the very same room, proceeding either round the sides or by the skirting boards, or under the flooring-boards; in the latter case, the improvement would simply consist in allowing the cold air to pass unfelt beneath the feet of any persons who may be sitting round the fire, instead of, as at present, very sensibly past their bodies. But if the absence of draft should cause a prejudicial stagnation of the air in the room, another plan might be adopted, either in conjunction with, or independently of, the last described; namely, to replace the air which should be consumed by the fire, instead of through the key-hole or other apertures, as usual, through a tube that should open into the room at a remote part from the fire-place, but yet should have previously passed

Digitized by Google

close behind or at the side of it, though without opening into it; thus, whatever air was supplied to the room would previously have been warmed by passing near the fire.

To obviate the unpleasant consequences which have, I believe, sometimes been found to arise from the admission of air into rooms which have been previously heated, I would recommend a particular consideration of the different degrees of affinity for oxygen of different materials which might be used for heating it. Of course, if the affinity be great, the air is more likely to be injured by the contact. If iron plates or pipes be used, would they not reject any further addition of oxygen if they were first bronzed like gun barrels? Again, surely the excessive dryness which has sometimes been given to heated air, might be most readily obviated by the admission of a limited quantity of steam into the tubes with it, or by a very small and finely-divided jet of water, or by making the air pass over the surface of a cistern of water.

I would now point out an economical way of applying the system of warming buildings with flues or tubes, either of hot air or hot water, to private houses, particularly those inhabited by the poorer classes of society; viz. to do it wholesale, as it might be called, by having one heating apparatus common to whole ranges of houses, the proprietor of which might levy a rate for the purpose of defraying the expense, similar to that raised by the water companies. If hot water were used, there might be one main pipe leading from the boiler, about half way up the walls of the houses, and another return to it, leading through all the basement stories; and these pipes might, in each separate house upon which the rate for warming was levied, be connected with each other by several intermediate pipes, which, rising from the highest and hottest main to the upper stories, should curve round and descend to the lowest main in the basement; and then, by cocks upon the intermediate pipes, the inmates of each house might regulate the degree of heat they wished to receive in their own, or in any room of it, at the same time that the currents through the straight mains were uninterrupted.

I am, Sir, yours, &c.

GEORGE MACKENZIE,
Architectural Draughtsman.

*Prussic Acid.*—Seeds steeped in prussic acid either die or lose the power of germinating; and the more delicate the vegetable, the more rapidly it perishes.

## ON THE CABIRIC MYSTERIES AND PHŒNICIAN ANTIQUITIES.

At a meeting of the Royal Irish Academy, Sir William Betham lately read a paper, wherein he stated his conviction that the Cabiri were a secret society or brotherhood, who concealed their acquirements in science and the arts from all but the initiated; that this society originated with the Phœnicians, and was for a very long period confined to that people and their colonies; that the arts of navigation, mining, &c., the science of astronomy, and indeed all other branches of knowledge with which they were acquainted, were enveloped by them in mystic fables and allegories, to conceal them from the vulgar; and from these was derived the old system of mythological theology of the Greeks and Romans. That the word Cabiri, in Celto-Phœnician, literally means *the confederacy or brotherhood of science. Cabar* is *a confederacy* or *secret society*, i, *of science.* The four *degrees* or *steps of initiation* into this order were named Axieros, Axiochersa, Axiochersus, and Camillus, or Casmillos. These were made deities by the Greeks, the Phœnicians themselves encouraging or perhaps propagating an error, the explanation of which was part of the secrets of the confederacy. The confederacy itself originated at a very early period of Phœnician history, and seems to have partaken of the essence of the policy by which that people aimed to keep the world in ignorance, and to carry on in secret their extensive operations in commerce, navigation, and mining; the secrets of these arts being enveloped in terrible mysteries, which deterred the ignorant and unenlightened from interference. By these means they succeeded in securing to themselves for ages the exclusive sovereignty of the seas, the entire commerce, and the greater part of the wealth of the world. The discovery of the identity of the Celtic and Phœnician tongues has led to the true meaning of the names and nature of these imaginary Cabiric deities, which the author explained.—*Athenæum.*

*Naturalization of Sea Fish in Fresh Water.*—In Guernsey and other of the Channel islands, a plan is adopted for the purpose of naturalizing sea fish in fresh water. The fresh water is at first mixed with salt water to a considerable extent, but gradually is made only brackish. The fish seem to thrive well in it, and lose nothing either in flavour or firmness by the change. Mullets, plaice, turbot, smelts, &c. have been thus subjected to fresh water.

Digitized by Google

# THE CHEMIST.

## COMBUSTION.

NO. II.

When combustion proceeds with rapidity, and the union of oxygen with the combustible is accompanied with intense chemical action, flame is produced.

For the production of flame two conditions are necessary; first, in all ordinary cases, that oxygen should be present;* and secondly, that the combustible should be raised to a high degree of temperature.

Before proceeding, however, to describe the causes which produce flame, we may briefly notice the manner in which it has been regarded by various nations, at different periods of time. Man appears to be the only animal capable of making fire subservient to his use, and by its means increasing his enjoyment. We know of no animal that produces fire for the purpose of relieving its wants, or, indeed, under any circumstances whatever. Wild animals are terrified by it, and the traveller in the forest knows that his best protection against the ferocious animals that prowl by night, is a blazing fire. Indeed, beasts that have been domesticated, and thus in some manner familiarized with the appearance of flame, avoid it as much as possible; and it is well known that when the stables of a farm-house catch fire, great difficulty is experienced in saving the cattle, in consequence of their being terrified at the appearance of the flame.

As the power of making use of fire seems to be peculiar to man, it is not surprising that it should, in almost every uncivilized country, have been regarded with peculiar veneration. By many of the old philosophers it was esteemed a portion of the divine essence, and connected, in some mysterious manner, with the immaterial principle of man. Hence a flame was constantly kept burning in the temples of the heathen deities, and by some nations was actually worshipped as God; or, at least, as his attribute. In Persia this was universally the case; and the practice was not confined to that nation alone. In every age and country it has been regarded with some degree of awe and veneration. By the uncivilized man it is true it has been more highly prized than by those who have made greater advances in knowledge, but only because, to the former, it appeared more mysterious and wonderful. Both have alike been indebted to it for the greatest enjoyments of life; and if the merit of discovery is to be estimated by the good produced, no man deserved to be regarded with greater honour than the discoverer of the means of producing flame. Probably the fabled Prometheus might be that man.

The identity of light and heat, in various particulars, is a subject that has long engaged the attention of philosophers. In the production of flame the analogy is very striking. If we expose a body—a piece of iron for instance—to a high degree of temperature, it soon becomes red hot, the intensity of its redness increasing with the intensity of the heat applied. If the temperature continue to be raised, the colour of the iron changes, first to a dull yellow, and subsequently, after becoming brighter, to a white heat. In this state the light emitted from it is similar to solar light, with the exception that it will not pass through glass, accompanied by its heat, in the same manner that the former will.

We have stated, that under all ordinary circumstances it is necessary, for the purpose of combustion, that oxygen should be present. This may be proved by a variety of experiments: if we place an inverted glass jar over a candle, in a plate of water, so that the air can neither escape nor enter, in a very short time the candle will be extinguished; and if the air be examined it will be found that its oxygen has disappeared, and that an equal quantity of carbonic acid has been formed. A striking instance that oxygen is necessary for combustion is given at page 83 of our first vol. in describing a process in the manufacture of muslins, &c. They are passed over a *red hot* cylinder; but in consequence of being kept in close contact with it, the atmosphere cannot get between the muslin and the cylinder, and the former accordingly is passed over uninjured. The use of bellows in increasing the brightness of a fire depends simply on their forcing a greater quantity of air, and consequently of oxygen, into the fire than it would otherwise receive; and the use of glass chimneys for lamps and gas burners depends on the same principle; but as we have more to add on this subject than can conveniently be conveyed by this paper, we defer it for another article.

* Flame can be produced in chlorine gas; this is a strong reason for presuming that it is a compound of some body with oxygen.

*Boulder Stones.*—These are blocks of granite, found in several parts of Europe, at a great distance from any granite mountains. To account for their existence in such places has given birth to several geological theories.

Digitized by Google

## EXTRAORDINARY FALL OF THE BAROMETER.

THE following is extracted from a German paper:—"On the 23rd of January, 1824, at Leipsic, the barometer stood at 26° 11′, it having been (says the journalist) only three times as low, namely, in 1799, 1782, and 1783, during the whole of the eighteenth century. On referring to the meteorological journals kept in England and France, we observe, that in both these countries also the barometer stood very low on the same day. By the meteorological diary given in the Quarterly Journal of Science, it appears to have been at 28° 70′; and by the meteorological observations in the *Annales de de Physique et Chimie*, at 30° 71′, being in both cases considerably the lowest of the month, and much below the average of the year. At Paris and Leipsic the wind was S.W.; at Althorpe, in Northamptonshire, W.S.W. and N.W.; and it rained somewhat both at Paris and Leipsic."

## ELECTRICITY.

*To the Editor of the Penny Mechanic.*

SIR,—Being generally in the habit of carrying a small glass seal and a piece of good sealing-wax in my pocket, I often witness a very amusing phenomenon. My profession gives me a great deal of walking; or, I might rather say, walking a long distance home morning and evening, the friction of my trousers pocket, in which I carry the wax and seal, completely electrifies or charges both the seal and wax, and which, as a matter of course, are oppositely electrified, the glass containing vitreous and the wax resinous electricity; and the affinity or attraction of these opposite states are too well known to require description here; but if I use the seal and wax to take an impression, when just come off my journey, and of course when they are fully charged, upon taking the seal from the impression, long filaments immediately follow it. What surprises me is the extreme fineness and elasticity of these threads, which are as minute as those of the silk-worm. When both wax and glass have been highly charged, I have succeeded in drawing them out full a yard long, and folded them up like a silkworm's nest; and I have often amused myself by persuading my friends that I had succeeded in rearing silk-worms that spun red silk. This very simple experiment places in a clear light the celebrated law of Du Fay, which recognizes these two opposite fluids; their laws, &c. will be found in any treatise on electricity. Thus, by two machines, not weighing, together, one ounce, we can illustrate one of the two accepted laws of electricity. The experiment can be made by anybody, as it does not require care, provided the wax is good; common wax, I observe, does not succeed so well. I am, &c.

TYRO LOCK.

*Falling Stones.*—An account has been received from Brazil of the appearance of a meteor of extraordinary brightness, and as large as the balloons used by aeronauts. It was seen for more than sixty leagues in the province of Ceara, and over the village of Macao, at the entrance of the Rio Assu; it burst with a noise like thunder, and an immense quantity of stones fell from it, in a line extending more than ten leagues. The largest portion fell at the entrance of the river, and in various places they pierced through several dwellings, and buried themselves several feet deep in the sand. No human life was lost, but many oxen were killed, and others severely hurt. The weight of those taken out of the sand varied from one to eighty pounds.—*Glasgow Herald.*

*Tubus Calefactus.*—Our attention has been directed, by more than one correspondent, to a method of warming rooms, now exhibiting at the Jerusalem Coffee House. The truth is, that a report on this subject would have appeared two months since in the Athenæum, when the stove, or whatever it is called, was exhibited at the meeting of the Horticultural Society, but that we could only talk after the fashion of the famous bottle conjuror, and announce that some person unknown, by means unknown, professed to warm rooms at a very small cost. We thought it better, therefore, to wait for a short time, and until the mystery was revealed. But the same secresy is observed now that the exhibition is public. We regret this the more, because the discovery, if there be a discovery, is likely to be prejudiced by it. It is absurd to call people together by sound of gong, merely to send the thoughtless away gaping and wondering. It would have been time enough when the parties had secured their interests by patent, and were prepared to explain the mystery and execute orders. It is hardly necessary to add, that heat may be generated, and the effects exhibited produced in many different ways; and that the value of the discovery depends on the time the heat can be kept up, the height raised to, the cost of the material, and the influ-

Digitized by Google

ence of such combustion on health. For an answer to all these important questions we are to take the word of the projector. Now he may be a very honest man, and we are quite willing to believe that he is so—but projectors are apt to be sanguine. *Athenæum.*

*Effects of Vegetation on Carbonic Acid.* At the British Scientific Association, the the following paper was read by Dr. Dalton:—By numerous experiments made in hot-houses, he found that the quantity of carbonic acid was precisely the same both by day and by night, and was in no respect different in quantity from that of the external air. The idea that vegetation was necessary for the purification of the air, by decomposing the carbonic acid, he considered unfounded; for he calculated that in 5,000 years the respiration of the animals supposed to exist, would only produce ·001 of carbonic acid gas in our atmosphere.

*Fossils at Sausan.*—Further inspection increases the importance of the discoveries of M. Lartet and others, at Sausan, and fresh arrivals from him at the Academy of Sciences in Paris, produce new wonders. They combine the remains of animals, which, in all probability no longer exist in nature, with some which do not appear to differ from those actually in being: the mine is still far from being exhausted, and a more favourable opportunity for the observations of geologists never before presented itself. The bones of the rhinoceros most abound; after these come those of deer, with their horns, and if an estimation may be formed by their size, the remains of a small and elegant species of ass or horse must have been there deposited. New fragments of the *Macrotherium gigans* have come to light, which show that its claws bore a strong analogy to those of the Orycteropus. The bears must have been totally different from any yet discovered; and those bones which belong to an animal called Amphicyon, by M. Lartet, show a strong analogy between it and the dog.—*Athenæum.*

## INSTITUTIONS.

### MECHANICS' INSTITUTION, Southampton Buildings.

*Outlines of Lectures delivered in the Chemistry Class.*—The subject of copper was introduced to the members' notice. It appears that copper, or probably a combination of copper and other metals, were known to the Egyptians; for all the domestic and other utensils are of copper, or its alloys, which have been found in examining the pyramids, and other ruins, by modern travellers. We read in Scripture of brazen gates, images, &c., but iron is never mentioned, and has only been found in comparatively modern ruins. They must have been acquainted also with zinc, for zinc and copper are the compounds of brass. Their copper was manufactured in a tolerable state of purity. The following experiments were advanced: To clean native copper from its oxides, steep it a little time in a diluted solution of sulphuric acid, then rince it in cold water, rubbing it with a soft hair brush, and dry it quickly; it will remain perfectly clean and bright, and fit for the cabinet. Copper and sulphur readily combine when the sulphur is in a state of fusion, emitting both light and heat; the residuum is sulphuret of copper. If a clean knife be put in a solution of sulphate of copper, it immediately becomes coated with copper; the attraction is not so powerful as that of silver and mercury, for the copper, in the former case, is readily peeled off, whilst in the latter, friction cannot remove it, but evaporation will. It dries something like dirty frosted silver.

TYRO LOCK.

LECTURES DURING THE WEEK.

*Tower-street Mutual Instruction Society*, 16, Great Tower-street.—Feb. 5, Mr. A. Lee, on the Steam Engine.

*Southwark Literary Society.*—Feb. 7, E. Cowper, Esq., on Recent Improvements in Machinery.

## ANSWERS TO QUERIES.

"C. Parke" Fluor Spar can be purchased at Palmer's 103, Newgate-street, price 4d. per pound.

"J. E. Goddard." No. 53 contains a receipt for joining the gores of paper balloons.

## TO CORRESPONDENTS.

A Chemist *had better send the papers to our office, and if found to contain matter of general interest they shall be inserted.*

J. B.'s *Letter on a fire alarum shall appear; though we think the "remedy" proposed, without great care, might prove "worse than the disease."*

Y. Z. *There is nothing new in the plan; gas-stoves have been some time in use.*

Enquirer. *There is an iron rail-road, reaching from Croydon to Wandsworth, which was formed upwards of thirty years ago.*

Received, A Subscriber, Brighton—J. B—A, Z.—G. J. Gordred, Brighton, &c.

London: Printed at the Holloway Press, by D. A. Doudney; where all Communications are to be addressed (post paid); published by Berger, Holywell-street, Strand and may be had of all Booksellers.

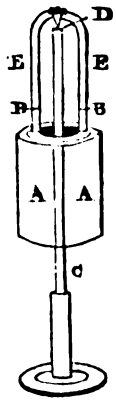
Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LXVIII.] SATURDAY, FEBRUARY 10, 1838. [Vol. II.


### ELECTRO-MAGNETISM.

FIG. I.




ELECTRO-MAGNETIC ENGINE.

FIG. I.

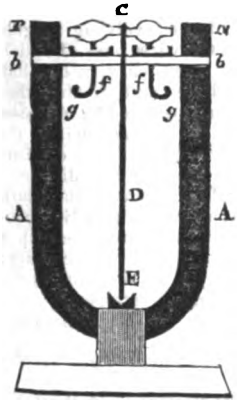



FIG. II.

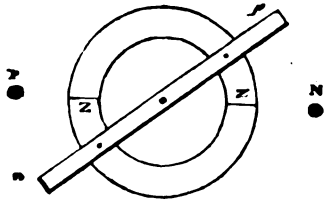
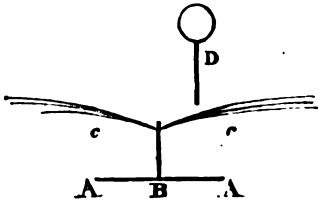



FIG. III.







Holloway Press: D. A. Doudney.



Digitized by Google

## ELECTRO-MAGNETISM.

*To the Editor of the* PENNY MECHANIC.

SIR,—The following is a description (accompanied by a drawing) of an apparatus contrived by Ampere, to show the revolution of the wire round a magnet, which possesses the advantage of containing the trough by which the electric current is produced. Yours, respectfully,

J. R. WATTS.

DESCRIPTION.—Fig. 1—A A, a trough, formed of two cylinders, of very thin copper, about two inches in depth; the outer one about two inches, and the inner about an inch and a quarter in diameter, joined below by a copper bottom. The inner cylinder has a copper wire, B B, fixed to it, so that it can be suspended on a magnet, C, which passes up within it, the suspension being by means of a fine-pointed wire from the bent part, D. Into the trough is placed a cylinder of sheet zinc, which has also a wire passing from one side to the other, E E, and suspended by a pointed wire passing down from the bent part, F, and placed in a small cup, containing a globule of mercury, fixed to the upper part of the bent wire, B B, of the trough. When the trough is filled with diluted acid, and the apparatus suspended on a powerful magnet, the zinc plate revolves in one direction and the copper trough in another, the direction varying according to the pole on which they are suspended. When on the north, the zinc revolves in the same direction as the hands of a watch lying on a table with the dial up, while the trough moves round in the opposite one. If the apparatus be suspended on the south pole the zinc turns in the reverse direction, while the trough goes in the same one with the handles.

## ELECTRO-MAGNETIC ENGINE.

THE principle on which this engine acts is the well-known one, that bodies, positively electrified, attract negative bodies and repel positive bodies. Fig. 1 represents a view of one of the many forms which the apparatus is capable of receiving. A A is a common horse-shoe magnet, having P, its positive, and N, its negative, pole. *b b* is a brass beam, going from one arm to the other, through which D, the rod of C, the electro-magnet works. C, the electro-magnet, is a bar of soft iron, bound round with silk-covered copper wire, two ends of which, one from each pole, are bent downwards, so as to run in a circular trough, F F, filled with mercury, and having two divisions, as hereafter described; from each of which divistons proceeds a copper wire, *g g*, which wires, when the machine is at work, are connected with the two poles of the battery. E is a cup, in which D, the electro-magnetic spindle, works. Fig. 2 represents a view of the circular trough, with the two ends of the horse-shoe magnet, P and N; also the electro-magnet, *n p*: these four letters respectively representing the states of their poles at Z Z. In the circular trough are two divisions, so that the trough is divided into two parts, each filled with mercury, into which dip the two wires previously described, from which mercurial troughs proceed two wires to the battery. Now supposing the battery in action, and the magnets as represented in Fig. 2, the revolving magnet, being negative, is attracted to P, the positive end of the horse-shoe magnet, at the other end the same takes place, when the wires attached to the revolving magnet pass the divisions Z Z, their polarity is changed, and the revolving magnet becomes positive, as well as the permanent one, so that repulsion takes place, and the same also takes place at the negative pole of the horse-shoe magnet, and in this manner by alternate attraction and repulsion the motion is kept up; the reason why the polarity of the revolving magnet is changed when the wires pass the divisions is, because the mercury in one-half the trough is positive, and in the other negative. Fig. 3 represents the division in the trough with the magnet wire; the wire must be sufficiently long to dip into the mercury, and yet pass the division; Every time the poles change a blue spark is seen. The battery is of a peculiar construction, so contrived as to keep up a weak but continued current of electricity; and sulphate of copper, in solution, is the exciting fluid used in the battery.

C. D. THOMAS.

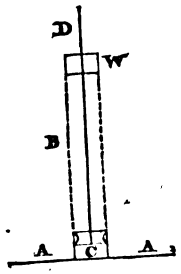
## SAFETY-VALVE.

*To the Editor of the Penny Mechanic.*

SIR,—There is a safety-valve, which does not appear to be so extensively known as its merits deserve, it being decidedly the safest valve yet constructed. It consists of a cylinder or pipe, fixed to the roof of the boiler, and having a series of holes drilled in it. In this cylinder works an air-tight piston, furnished with a rod, by which it is weighted. Now when the force of the steam exceeds the given weight, it will raise the piston, say as far as the first hole, and then escape. If, however, one hole should not be sufficient

Digitized by Google

for its escape, it will raise the piston to the second hole, and so on, till it has a sufficient vent; after which the piston will fall, and prevent the further escape of the steam.




DESCRIPTION.—A A, roof of boiler; B, cylinder, with holes; C, Piston; D, rod; W, weight.

C. D. THOMAS.

## DAVY'S ELECTRICAL TELEGRAPH.

WE have just seen this beautiful invention, now exhibiting at Exeter Hall, and illustrated by interesting experiments, and we shall endeavour to give some account of it to our readers; strongly, however, advising to visit for themselves, one of the first and most useful applications of that most extraordinary and subtle fluid, *electricity*.

If a piece of zinc, and another of copper, be placed near and opposite each other without touching, in a vessel containing an acid, such as oil of vitriol, diluted with water, the two metals will acquire opposite states of electricity. If now a metallic wire of some length be connected by solder, or any very perfect metallic contact with each metal, a current of what is called *voltaic electricity*, or *galvanism*, will constantly flow along each wire, from one end of it to the other.

This electric current possesses magnetic properties, and if the conducting wire be brought close over the needle of a mariner's compass, which points north and south, it will turn it out of its direction, and cause it to point east and west, or vice versa. The wire connecting the zinc and copper may be of very great length; for instance, many miles, and yet it will produce the same effects at any part of it.

If 26 magnetic needles, each bearing a letter of the alphabet, be fixed in as many coils of 26 wires, then on passing the galvanism to any one or other of these wires, the corresponding letter will be given as the signal; and letters may be signalled in succession, so as to form complete words and sentences. This is the elementary form of the apparatus described by a French philosopher many years ago; and a similar imperfect apparatus has recently been exhibiting publicly under a different name. The objections are the vibration of the needles, and the loss of time and liability to mistake, and also the length of space which the needles occupy; and the not having them all at once under view; besides the multiplicity of wires, and the expense. The plan has of course been considered as no way adapted for practice.

Mr. Davy has, by the application of some not generally-known principles, brought the invention to the greatest perfection, as may be believed from the following description:—Instead of 26 wires, Mr. Davy employs only six; and with these he can give upwards of 200 signals, including the 26 letters of the alphabet. Nothing whatever is seen of magnetic needles; there is a small dark screen, on which the letters (either singly, or combined into words, or arbitraries) start into view the instant the key at the opposite end is touched; and this would be the case as instantaneously, even though the wires extended from London to Portsmouth;—the length of distance, according to Mr. Davy's plan, making absolutely no difference whatever. The coming of a communication is always preceded by a sound or alarum; and a bell, struck by the action of a magnet, moved by electricity, separates the letters into words; the bell being rung at any distance by the electricity. The readiness, rapidity, and certainty of this apparatus surpasses all expectation.

This invention requires only to be known to be adopted; its expense, when considered as a public expense, will be a mere trifle, compared with the objects it will effect. It must supersede the common telegraph, and, when general all over the country, it will enable all the country papers to publish the London news as early as the London papers themselves. Possibly it may eventually be taken up by Government as a branch of the Public Post Office.

## FIRE ALARUMS.

*To the Editor of the Penny Mechanic.*

SIR,—Happening to see in one of your Numbers, a proposed method of escaping from a house on fire, by means of "Plummer's Fire Staircase," the idea occurred to me of a method for giving prompt and audible alarm on its commencement, so as

Digitized by Google

to arouse the inmates, and give notice to any watchman who may be casually passing; for it is too well known, from woful experience, that the silent encroachments of an early or recently-commenced fire, rather tends, by its development of stupifying gasses, to prolong the slumbers of the unfortunate inmates, and render them more profound than to awaken them. But by a well-timed alarm, many precious lives and much valuable property might be saved. Now to accomplish this desirable object, I propose that a brass box should be screwed on to such places as over window-curtains, on the tops of bed-posts, or in any situation where a fire is likely to commence from accident or neglect. The box made to be unscrewed in the centre, in order to admit a sufficient quantity of powder to make a good loud report when ignited, by means of the touch-paper, which is to be placed at the end similar to a squib. The points may be of ornamental fancy-coloured touch-paper, when this useful ornament is to be fixed in a smart apartment, &c. Let us suppose that a candle is left on a table, chest of drawers, or some such situation near a window, and the breeze, during the absence of the servant or other person who might have left the light there, to have wafted the curtain within reach of the flame, it is possible that in ten minutes more the destruction of the house would be inevitable, according to circumstances; but if one of the proposed ornaments had been placed there, the alarm of the report might draw attention to the spot in sufficient time to extinguish the flame, or at least to prevent the wainscot, shutters, or ceiling from taking fire.

In any large detached building or manufactory, larger ones might be employed with proper caution, so as to make sufficient report to be heard at any required distance. A sufficient number of these shells might be distributed in different apartments of a house, as well as in out-houses, so as to ensure a speedy alarm in case of fire. Several successive reports might be induced, by placing a cracker in the box; this would, perhaps, be more likely to arouse and give alarm than a single report. J. B.

[This is rather a *startling* sort of fire-alarum, we must confess. Our correspondent seems to have some faith in the old adage, "Set a thief to catch a thief."]

*Durham and Sunderland Railway.*—This Company intend to create 1000 additional shares, which has met with great support.

## ON THE CRANK.

SIR,—In a letter signed C. D. Thomas, in No. 66 of your publication, it is stated that the crank is the best plan possible for changing a reciprocal motion to a rotary one; but I beg leave to differ with Mr. Thomas on that point, having paid considerable attention to the subject for some time, and at length fixed on a plan that will produce equal power on the whole revolution. At present there appears to be a considerable loss of power, and not attended with a small portion of danger, in certain cases where the engines happen to stop on the centres. My plan will entirely remove all difficulty on this point; but who will undertake to bring it into use, and remunerate me for the trouble I have taken (and which has not been trifling)? I have devoted many months anxiously to it, and have at last rendered it both simple and effective. England, that boasts of her freedom, may also proclaim to the world her laws that prevent the poor man having a patent to insure to him remuneration for the improvements he may be so fortunate as to introduce, and which may prove of the utmost consequence to the community. Let a poor man apply to the authorities for a patent, he will find that nothing of the kind can be had without money. It seems as though our legislators considered the working mechanic quite unequal to the task of thinking, and that improvements can only be made by those persons who may be in affluence.

If Mr. Thomas would wish to inspect a sketch of my plan, I will attend on him any evening he may please to appoint after eight o'clock, at any place within three miles of St. Paul's. I am, Sir, yours, &c.

Jan. 30th, 1838. T. E. M.

*Carriages which do not upset.*—Some experiments have recently been made at Paris with carriages having six wheels, and so fitted up that they can be driven over mounds of three or four feet high without being upset. Five vehicles were attached to a train, and they were drawn rapidly in various directions, turning the sharpest corners, and moving in a circle, and they are reported to have kept their equillibrium so admirably, that, notwithstanding the rapidity of the motion, persons in the carriages can pour out liquids and drink them without a drop being spilled.

The King of Holland, it is said, has refused his sanction to the project for uniting Amsterdam and Rotterdam by a railroad.—*Globe.*

Digitized by Google

## NEW STEAM-ENGINE.

THE "Birmingham Herald" gives a description of a new rotary steam-engine, constructed by a labouring mechanic. "Its size is not more than twice that of a man's hat, and the expense of a five horse-power will not exceed in cost half-a-score pounds. Its form is cylindrical, being about 18 inches in diameter, and 22 deep. The steam is admitted through a hole in a hollow circular belt (attached to a wall), upon which it revolves, and works it by a diagonal action, against an upright piston, being forced out by pressure of a diagonal plate, which divides the interior into two portions. The rotary action is beautifully managed by means of a perfectly spherical steam-tight joint, at the end of a fixed inclined arm, towards which joint the upper and lower surfaces of the interior part of the cylinder are made to slope, after the form of the exterior of an hour-glass. Upon these the diagonal plate performs its revolutions, such movement being permitted through an opening (from the circumference to the centre), equal in width to the thickness of the before-named upright piston, up and down the sides of which it continually works. To the centre of the bottom of the cylinder is fixed a shaft, having attached to it a wheel which communicates the motion that may be required; and this is all the machinery of which it consists!!"

[This is the invention of a labouring man, be it remembered. Now, supposing this discovery should be found of national importance, and no wealthy individual come forward with his purse to procure a patent for him, he must either give up a portion of the profits arising from its sale to some opulent manufacturer who can find the *thing needful*, (and, no doubt, one will be found to join him on these conditions), or he will have the mortification of seeing masters reaping the benefit of his ingenuity, when, perhaps, he is pining away his days in old age, and neglected poverty. Besides, the fact of his making known the particulars of his invention to four persons will preclude him from the right of a patent. We hope before long, to see things better managed, and the inventions of the poor man receive equal protection with those of the rich.]

## GREAT WESTERN RAILWAY.

SOME experimental trials were made on the wide gage, and with the new locomotives, on a small portion of the London end of this line of railway, in the early part of last month, the results of which appear to have been highly satisfactory. A friend of ours, present, writes to us, "I can fully confirm the favourable report in the 'Bristol Mercury,'" an extract from which we subjoin. "Some uneasiness," says he, "it is true, was felt in the motion of the carriage attached to the engine, but this was found to be owing to its springs not having got into play, and the consequent jolting of the body upon part of the framework. Nothing of this was found when riding on the engine itself (generally an uncomfortable post), which shows that the fault was not in the rails. I could stand with one foot on the tender and the other on the engine with ease, without holding by anything, whilst travelling at a rate of nearly forty miles per hour. I should be sorry to try this on any other railway I have yet seen. But, apart from the ease and comfort of the passengers, I cannot but think that even a much greater advantage is secured to the proprietors by Mr. Brunel's mode of construction, in the low cost of maintenance to which this system appears to be liable. There is so little of violence or opposition offered to the passage of the locomotives, even at their highest speed, and the pressure is so evenly distributed over an extensive space at one and the same time, that it appears almost impossible to subject the engines to less strain, or to construct a roadway liable to less derangement. Experience, it is true, is the only thing that will give decisive proof on these points; but I firmly believe that if Mr. Stephenson's estimate of one-third of the receipts for the annual cost of maintenance, &c., should ever be realized (which, as yet, never has been the case), the Great Western Railway will be the first to reduce it to practice."—*Railway Magazine.*

## SOUTHAMPTON RAILWAY.

BY the first of May, we believe, the public may confidently rely on 23 miles of this line being opened to them, as we have before stated; that is, from London to Woking Common. If the weather prove favourable, we have reason to believe it might be very well opened a month or two earlier; but the Directors have prudently resolved not to commit the fault of opening too soon. The line to Kingston, we understand, is completed.—*Railway Magazine.*

Digitized by Google

# THE CHEMIST.

## COPPER.

This metal is a very common source of poisoning, inasmuch as it is continually employed for culinary purposes. It is very remarkable, yet no less true, that as the science of gastronomy has advanced, the various salts of this metal (each of which be it remembered is poisonous) have been more called into requisition. Thus we see that to give pickles a certain delicate green, they are kept in copper jars, not in the least protected with tin. The action of the acid upon these jars produce an acetate of copper, or verdigris. In preserves we see the same dangerous error again fallen into. Fruits, containing certain acids, as citric, mallic, &c., act in the same manner (though perhaps not in so great a degree) as the vinegar of the pickles. The same effect is produced in the cooking of animal food in saucepans of this metal; the oil, or fat, of the meat usually contains an acid called the sebaccic, which also forms an injurious salt with copper. All culinary vessels made of this metal should have a coating (never mind how thin) of tin, to preserve its contents from immediate contact with the copper; a piece of iron, if continually kept in the vessel, will prevent, to a very great extent, the action of acids upon it, but it being coated is far better. Some persons think if the pot, or pan, be repeatedly scoured and kept clean and bright, that there will be little or no danger; but this, we can assure them, makes but a small difference.

Copper, however, appears to us in some other forms than those just mentioned; as for instance in ink, where it is sucked in so deliciously by the school-boy. It is also employed on gilt ginger-bread, and various other ways.

*Tests for the discovery of its presence.*

1. To the liquid supposed to contain it add a little prussiate of potass, and it will, if present, become brown.

2. Add a little arseniate of potass, and a beautiful green will be produced, known by the name of Scheele's mineral green.

3. Add ammonia, and a beautiful violet will be seen.

4. If a piece of polished iron, such as the blade of a pen-knife, be immersed in the liquid, and allowed to remain therein a short time, it will be covered with a thin film of copper.

5. The same effect is produced on polished steel, or clean iron-filings.

### PRUSSIC ACID.

Little need be said upon the nature or effect of this well-known dangerous poison, which can generally be detected by its peculiar smell, resembling bitter almonds. It may be tested with pure potass in solution, to which must be added a little sulphate of iron, which will turn it blue; or sulphate of copper, which will produce a brown colour.

W. Burbridge.

## NITROUS OXIDE; OR, LAUGHING GAS.

The establishment of Temperance Societies, and the general diffusion of teetotalism, would appear, at first sight, to have little to do with nitrous oxide gas; but when the inefficiency of the efforts of these tea-drinking companies, for the suppression of a growing evil, are considered, a *spirit* of philanthropy, actuated by the fact, suggests a more pleasant and considerably less objectionable plan for putting down the evil, in the shape of nitro oxide gas, which produces none of those injuries arising from ordinary fuddling,—such as head-ache, indigestion, and its train of bad consequences,—but, on the contrary, a pleasurable sensation, infinitely superior to any other, as confirmed by the evidence of Sir H. Davy, Mr. Priestley, Mr. Southey, and others; these too, without making a cistern of the stomach, or running any risk of being fined 5s. for drunkenness. Having said thus much I shall now state what I have recently seen and experienced at a meeting of amateur chemists. The gas was made in the way described in No. 46 of The Penny Mechanic. The first person who inhaled it was a young man of a naturally vivacious turn, and his exhibition excited no little amusement; his pugilistic efforts were indiscriminately levelled at all in quick succession, alternated with bursts of laughter. The second person was of a different temperament—though none the less amusing—he had not much tendency to muscular action—at least as compared with the first. Before he had finished taking the gas, his feet began to move involuntarily, and his head to shake; but when he had done, his skeleton-like figure danced like an Italian's monkey under torture. Shaking a head with a profusion of long hair conveyed to the beholders a most ludicrous appearance. Another person who took it manifested an inclination for rolling on the floor, accompanied, as with the others, with fits of laughter. Several others inhaled the gas, and on all was experienced similar results. The effect on myself was

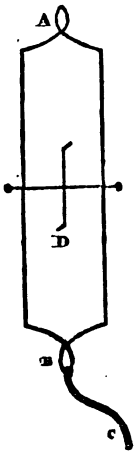
Digitized by Google

singular, first a giddiness with a heated sensation in my head, accompanied with a highly pleasurable feeling, with a sense of weight at my chest; at this time I became unconscious, and on recovering, found my arms akimbo, having given my friends (as they say) no inapt idea of Buonaparte's musing on the sea-shore. If the above remarks are at all calculated to convert the tap-room into a laboratory, or spirits into fuel for making nitro oxide gas, I shall think a good end answered.

*Brighton, Jan.* 24. CHEMICUS, JUN.

## ELECTRICITY.

*To the Editor of the Penny Mechanic.*




SIR,—Every thing which tends to render certain facts manifest by easier and less expensive means than have been previously employed, must be an improvement; and in the construction of all kinds of philosophical apparatus too much attention cannot be paid to this point.

In experiments with the electrical machine a small piece of apparatus is sometimes used to show the force with which electricity is given off by points, in which a wheel is made to roll along two wires stretched on glass pillars, and is called an inclined plane. This, if purchased of the philosophical instrument makers, is an expensive toy, and even if constructed by yourself, would occupy several hours to do it in the roughest manner. I remember reading a short time since (in a work in which electricity was treated of, but where, at the present moment, I cannot exactly recollect) of a plan for an inclined plane of very simple construction, and thinking it would not be unacceptable to your numerous readers, have sent a sketch and description of it.

This inclined plane is formed from one piece of wire bent to the form represented in the annexed drawing (the two ends of the wire should be soldered together) and attached at A by a small hook to the prime-conductor of the machine, the other end B is held in the hand by the silken cord C; place on it the wheel D, and slightly incline the wire, and you have an excellent inclined plane.

SCIOLISTERUS.

## AN ELECTROMETER,

*Used for the detection of the presence of Electricity.*

A VERY good one may be made by notching a 4 oz. glass phial with a file, and then leading a red-hot iron first to the notch, and then gently round the phial, as the crack extends: by this means, the bottom of the bottle is cut off. Then paste two slips of tinfoil or gold leaf opposite each other, inside the bottle, and through the cork thrust a ball and wire, with two slips of gold leaf suspended from it; the bottle may then be fitted into a piece of wood. ELECTRON.

## INCOMBUSTIBLE THATCH.

IT has been proved by repeated experiments, that straw, saturated with a solution of lime, or common whitewash, is incombustible. This fact is of great importance to the rural population, especially as thatch is thus not only rendered fireproof, but much more durable. A solution of alum has been tried, but being soluble, the rain destroys its virtues.—*Railway Magazine.*

Digitized by Google

# INSTITUTIONS.

LECTURES DURING THE WEEK.

*Tower-street Mutual Instruction Society*, 16, Great Tower-street.—Feb. 12, Mr. Sherman, on the beauties of Dramatic Poets.

*Southwark Literary Society.*—Feb. 14, A. B. Granville, on Egyptian Mummies.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Having occasion to use plate-powder very often, such as that sold in boxes at 1s. each, I should feel extremely obliged to you, or any of your Correspondents, by informing me how I can manufacture some.

A SUBSCRIBER.

SIR,—Could any of your intelligent Correspondents inform me how I can prepare tracing paper?

CONSTANT READER.

[See No. 30, Penny Mechanic.]

SIR,—Can you or any of your numerous readers inform me the best way to take grease out of paper.—Also, how to make indian-rubber glue? JEAN

*Electrical Shock from a Cat.*—The electricity excited upon rubbing the back of a cat is well known, as well as that it is rendered evident by a snapping noise and sparks of light, but I believe it is not so generally known that an electrical shock can be obtained in nearly the same manner. It can, however, be done as follows:—Take a cat—if a black one all the better—and having well warmed her back before the fire, make her sit on your knee; then place your left hand under her throat, with the middle finger and the thumb gently pressing the bones of the animal's shoulder, at the same time pass your right hand along her back, and slight electrical shocks will be felt in the left hand; and again, if the right hand be placed under her throat, whilst the left rubs her back, the shocks will be felt in the right hand. I have performed the foregoing experiment many times lately, but could never make out the *rationale* satisfactorily to myself. Perhaps one of your able Correspondents, "Z. Wigo," or "Electron, Jun." would be so kind as to investigate the matter, and favour us with an article on the subject.

H. H. CLARK.

## ANSWERS TO QUERIES.

SIR,—I beg leave, through the medium of your Magazine, to answer the query put by one of your Correspondents, respecting the difference in power between a six-feet and a twelve-feet wheel of the same weight. He states he has a wheel six feet in diameter, of such a weight, working so much machinery. Now (allowing the wheel to be a lever-wheel*) twice this quantity of machinery could be worked with a twelve-feet wheel, with the same power and with the same ease as the machinery worked by the six-feet wheel, but with only half the velocity; therefore, if he wishes to have the same power, together with the same velocicity, the man or power must turn the large wheel as many times as he would turn the little wheel, thereby turning the large wheel with twice tho velocity (that is, with twice the number of feet per second or minute), and consequently with not so much ease; in one word, if you gain power you lose speed, and if you gain speed you lose power.

CONSTANT READER.

*Speculum.*—Mr. Edwards affirms that different kinds of copper require different doses of tin to produce the most perfect whiteness. If the dose of tin be too small, which is the fault most easily remedied, the composition will be yellowish; if it be too great, the composition will be of a grey colour, and dull appearance. He casts the speculum in sand with the face; takes its out while red hot, and places in hot wood-ashes to cool, without which precaution it would break in cooling. Mr. Little recommends the following proportions:—32 parts of the best bar copper, 4 of brass pin wire, 16½ of tin, and 1¼ of arsenic. Silver he rejects, as it has an extraordinary effect of softening the metal; and he found that the compound was not susceptible of the highest polish unless it was extremely brittle. He first melts the brass and adds to it about an equal weight of tin: when this mixture is cold he puts it into the copper. Previously fused with black flux, adds the remainder of the tin, and lastly the arsenic; this mixture he graduates by pouring it into cold water, as Mr. Edwards did, and fuses it a second time for casting. H. SPAIGHT.

"W. T. Tambrille."—1st. The process of sending persons to sleep is termed animal magnetism; but the faculty in England have no faith in it.—2nd. A common-sized man consumes about 46,000 cubic inches of oxygen per day, and makes about twenty respirations in a minute; but these circumstances vary in different individuals.—3rd. The nearest fixed star to us is the dog-star, or Sirius. Mathematicians have computed his distance from us to be two billions and two hundred thousand millions of miles. The motion of light, therefore, which, though so quick as to be commonly thought instantaneous, takes up more time in travelling from the stars to us than we do in making a West India voyage. A sound would not arrive to us from thence in 50,000 years; which next to light, is considered as the quickest body we are acquainted with. And a cannon-ball flying at the rate of 480 miles an hour, would not reach us in 700,000 years.

SIR,—As "Q. E. D." has not answered "J. S. H.'s" query in Number 56, I will endeavour to do it: but he has not said which pulley is to correspond with the 24 in. groove; if the 3 in., then a 22½ in. groove will be required for the 4½ in.; and a 21 in. groove for the 6 in. pulley. He will see by this, that in proportion as the diameters of the pulleys are increased, so the diameter of the corresponding wheel must be decreased. The distance of centres is immaterial.

J. T. G.

P.S.—I should wish to remind your scientific Correspondents that we are not all versed in algebra who read the "Penny Mechanic." I should like to see a few common figures used.

"A Constant Reader" can purchase flexible pipe at Warne's, Jewin Cresent.

*How to transfer Figures on Glass.*—Draw on paper the subject you desire to paint. Lay it on a table or any flat surface, and place the glass over it: then draw the outlines, with a very fine pencil, in varnish mixed with black paint, and when dry, fill up the other parts with their proper colours. Transparent colours must be used for this purpose, such as carmine, lake, prussian blue, verdigris, sulphate of iron, tincture of brazil wood, gambouge, &c.; and these must be tempered with a strong white varnish, to prevent their peeling off, then shade them with black, or with bistre, mixed with the same varnish.

J. E. GODDARD.

## TO CORRESPONDENTS.

*Correspondents are informed, that Poetry is never introduced within the pages of* The Penny Mechanic.

*If* Mr. Matthews *will send us the paper and drawing of his Safeguard for Steam Carriages, it shall be noticed; but we cannot promise a very early insertion, as we have several sketches by us at present, which we have promised to publish.*

Received, Sigma—N.—An Engraver—G. H.—Well-wisher, &c., &c.

* A lever-wheel is a wheel when used as a lever, the power of that lever being—in proportion—according to the radius of the wheel.

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand and may be had of all Booksellers.

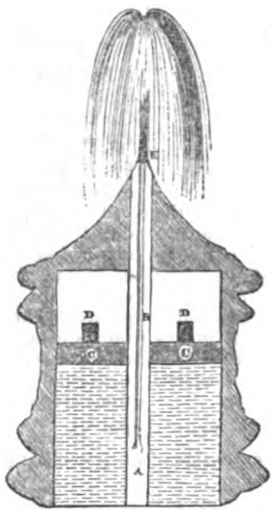
Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LXIX.] SATURDAY, FEBRUARY 17, 1838. [Vol. II.

### GARDEN-FOUNTAIN.

FIG. I.



### ELECTRICAL-MACHINE.

FIG. II.

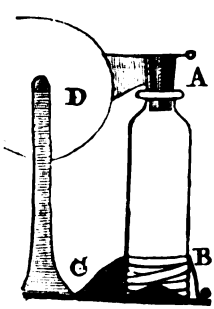
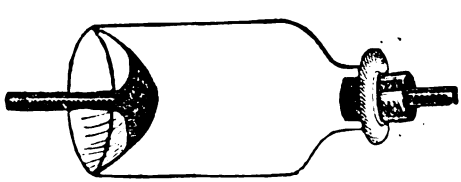



FIG. III.





Holloway Press: D. A. Doudney.

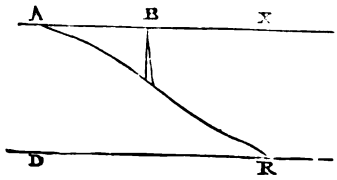
Digitized by Google

## ON LEVELLING.

NO. IV.

PROPOSITION IV.

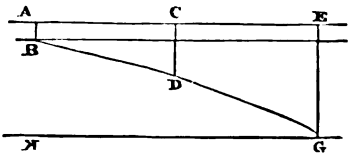
The standard or base line is always in the plane of the horizon.




For let A B be the surface, and A the starting point, and suppose the instrument at B perfectly adjusted, then will the visual ray, A X, cutting the staff, be in the horizontal plane, and A X, indefinitely produced, is the standard base line; therefore the standard base line must be in the plane of the horizon. The use of this proposition will be seen in a subsequent article.

PROPOSITION V.

The difference of level of any two places taken by the spirit level, is as the difference of the fore and back sights.

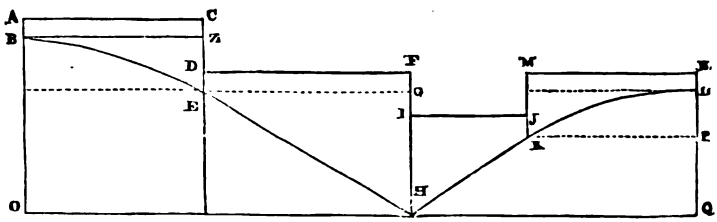



For let B C be the surface; A B the back sight; C D the place of level: then is F G the true difference required; for A B — E G = F G, because of the parallels A E & B F or {back sight} — {fore sight} = true difference of level required.

This proposition might have been deduced directly from (prop. 1); but as distinction is my aim, I thought it would be best to give them separate; the difference of the two methods is obvious at a glance. The next proposition will contain a general rule involving all the preceding cases, which is the common practical rule by which all levelling observations are reduced, &c.

PROPOSITION VI.

Being the general extension of the preceding propositions.




Let B be the commencing point, E H K L any intermediate points, L being the terminating point:

Then B A — C E = Z E } both being falls;
D E — F H = G H }
∴ Z E + G H = B O = reduced level to point H being falls.
And I H — J K = P Q } both rising.
M K — N L = L P }
∴ P Q + L P = L Q = reduced level.

Now at the point H, the difference of curvature commences, and thence obviously the true difference of level of B and L, is equal to the difference of level of B O and L Q.

= B O — L Q = difference.

{Z E + G H} — {P Q + L P} = difference.

{ {B A + D E} — {C E + F H} } — { {I H + M K} — {J K + N L} } = difference.

= { (B A + D E) + (I H + M K) } — { (C E + F H) + (J K + N L) } = difference.

= { (Sum of back sights) } — { (sum of fore sights) } = true difference.

Which is the general practical rule geometrically deduced, and which expresses both geometrically and verbally the rule; this is mostly used in practice.

Digitized by Google

The above is a complete solution of the question, viz. that of finding a general rule for reducing the levels from the field-book previous to laying down any section in plan; it is obvious how the proof is obtained. I have first given expressions for each of the falls or rise as the case is, and then their difference, which is finally expressed as B O — L Q = difference, in which the values of B O and L Q from the first expressions are substituted; and then by transposing all these with the same signs, to the same side, we get two quantities involving the sum of all the fore sights, and the sum of all the back sights, which, by taking their difference, gives the true difference, according to (prop. 6.) The dots in topmost lines is the supposed places of the levelling instrument; and in this case, for the sake of simplicity only, the surface is supposed to touch the base line at the point H; but it is plain that it is just the same whether it happen to be above or below the line, the process being evidently the same. In the preceding tracks I have not noticed the rule for simultaneous levels, which is simply the following. Subtract the successive sights from each other continually, and the sum of their differences will be the true reduced level required: this rule does not require any demonstration on account of its simplicity. The whole of these rules are remarkable for their simplicity, and the ease with which they may be verified and demonstrated; they are, as I hope, deduced from pure logical principles; and as this mode of treating the subject is new to myself, and most of your readers, I hope it may not prove either uninteresting or useless. This paper concludes the demonstration of the rules; my next will show, by examples, the method of applying them.

Jan. 14, 1838. TYRO LOCK.

## COMBUSTION.

THE following question is asked by "A. R. Y. Z." in No. 58. "*It is well known that a poker, when placed across the fire, creates a more rapid combustion of the fuel; how is this effect produced?*"

Much unprofitable discussion would be avoided, if we were always careful to ascertain the reality of a fact before we speculate upon its cause. So many erroneous notions are said to be "undeniably true," "known to every body," &c., that little, or no reliance can probably be placed upon testimony of this nature. The coincidence of two events, however dissimilar they may be in their nature and tendency, often leads to the erroneous inference that one is dependant upon the other; thus a sick person fancies he is cured by taking a nostrum, when in reality, he is cured by the action of nature, not *with the aid of*, but *notwithstanding* the nostrum; so I believe it to be when a poker is placed across the fire: the poker does not make the fire burn, but it burns in spite of the poker. I have tried the experiment several times, and could never perceive that the poker affected the progress of combustion in any degree. The idea of a cold bar of iron imparting to the coals an aptness for combustion, cannot, I think, be entertained; neither can it promote the current of air through the fire, so long as it remains colder than the surrounding air; but will, on the contrary, retard the ascending column, by absorbing its heat, and consequently condensing it. I have asked several persons, who practice this manœuvre, why they do it? hoping that their answer might be founded upon some traditionary theory, but in this too I failed; one says it "divides the draught," another that it "attracts the heat," another that it "draws the moisture from the coals," and it is my painful duty to say, that another, (a lady) does it "because it vexes her husband:" neither of these reasons have any intelligible meaning; finding therefore that pokerology is unsupported by reason and experiment, and even its professors adduce no argument in its favour, I dismiss it as a fallacious science, and consign it to the suburbs of my mind, there to dwell with astrology, homœpathy, phrenology, witch and other crafts, soothsaying seriousness,* necromancy, tee-totalism, and animal magnetism. Q. E. D.

## STEAM-ENGINE CRANKS.

THE very strange remarks which have recently appeared in the Penny Mechanic, on the action of the crank in steam-engines, induce me to lay before the readers of this work, a brief outline of the chief properties of that important member of the most valuable of all machines.

1st. The whole force of the steam expended in raising the piston, is effective in the production of rotatory motion in the crank.

2nd. Every equal portion of the piston's ascent, produces equal effect in propelling the machine.

* "Seriousness" is a technical term employed to designate that vice which the uninitiated call *hypocricy* With this definition, (and I use it here in no other sense), I shall not, I trust, be blamed for discarding it.

Digitized by Google

3rd. The effective pressure is to the whole pressure of the piston, as the radius of the circle described by the crank to the sine of the angle of the crank, from the perpendicular, (the connecting rod is here supposed to move parallel to itself; the effect of its angular motion is referred to a separate correction for the purpose of simplifying this proposition).

4th. The relative velocity of the piston is as the sine of the angle of the crank, and also proportional to the effective force impressed upon the crank.

5th. The mean effective force on the machine during the piston's ascent, is to the maximum (90°, when sin. = rad.) as twice diameter to circumference, or 7 to 11 nearly.

6th. If two pistons act upon cranks placed at right angles with each other, on the same axis, the maximum of their combined forces is when they are at equal distances from the perpendicular, or direction of pressure, and the minimum when one is at zero, and the other at 90°; 2 sin. 45° being greater than rad., and any deviation from that point will lesson the sine of one angle, more than it inereases the sine of the other.

My present object is not to expatiate upon this subject, nor to exhibit all the data upon which calculations may be founded; I merely wish, if possible, to avert an impending controversy, by recommending to the consideration of the parties alluded to, these propositions as their observations have suggested. They certainly appear to me, too manifestly true to require demonstration; but should a wish to that effect be expressed, I will with pleasure explain them more fully. I am aware of the prevalence of a notion that power is lost in the action of the crank: but let it be observed, that when the crank is at zero, no steam is expended, and in every other position, so much steam only is expended, as is effective in the production of motion. The effect is exactly the same as if the piston were to act successively upon all the parts of a straight lever extending from the centre to the circumference of the circle described by the crank. The force is unequally distributed, but not diminished.

It must be observed that the foregoing applies only to the essential properties of the crank, supposing the pressure on the piston to be continued uniform, without consideration of the various effects which which may be produced by friction on any peculiar construction of the machine.

It must be observed that the foregoing applies only to the essential properties of the crank, supposing the pressure on the piston to be continued uniform, without consideration of the various effects which may be produced by friction, or any peculiar construction of the machine.

Q. E. D.

## NEW METHOD OF WARMING ROOMS, &c.

THE discovery noticed in our No. 63, of a new method of generating heat in a small confined vessel, sufficient to warm a room of considerable size, is exciting a good deal of attention at the present time. The discovery appears to have been the result of accident, rather than of experiments made for the purpose. The properties of the combustible employed were first noticed by a gardener, but being a poor man he had no means of securing to himself the benefits of the discovery. A gentleman of considerable influence in the city, becoming acquainted with the circumstances, very generously came forward and assisted him, and patents are now being taken out for Great Britain, France, &c. There can be no doubt, if the piece of apparatus is capable of producing the effects attributed to it, that the invention is one of the most important that has been made for some years. There is probably no country in which dwelling-houses are so imperfectly, although so expensively warmed, as in England; and the advantages of possessing an elegant piece of apparatus, by which a comfortable degree of heat may be maintained, and that too at the least possible expense, are too obvious, therefore, to require a detailed notice. The nature of the combustible employed at present remains a secret, although many ingenious suggestions have been made to account for its peculiarities. One is, that the gardener who discovered the fuel which enabled him to keep up a fire whilst he slept, must have used old tanners' bark, as that was the only fuel accessible in a hot-house. Others suppose that charcoal is the base; and that lime is employed to absorb the carbonic acid. It is said that Gipsies are in the habit of using the ashes of their fires, raked together in a heap, and sprinkled with lime; this will burn throughout the night and give out much heat, and no deteriorating gas is evolved to distress the sleepers. This application of lime might be found eminently useful in factories, &c., where charcoal is burnt, to prevent the carbonic gas that is generated from producing any deleterious effects on the persons at work. It is well known that

Digitized by Google

when water is poured on lime very considerable heat is given out, and some persons have asserted that this is the secret of the invention. It is questionable, however, whether any great degree of heat could be maintained for any length of time by this method; and this the instrument is capable of producing. Whatever may be the nature of the combustible, it is capable of producing a very agreeable degree of heat for a considerable length of time: it is said that it is only necessary to replenish the stove in which it is burned once in thirty hours. The prices of them will vary from two guineas to one hundred; but it is said that the saving in fuel will soon repay the outlay.

## ELECTRICAL TELEGRAPH.

*To the Editor of the Penny Mechanic.*

I HAVE been much pleased with the electrical telegraph of your modest but talented correspondent L., and must certainly give it my most hearty recommendation to the notice of the public—and for what reason—that for which many other people might reject it for—its extreme simplicity. All other machines that I have seen are much too complex ever to be brought to actual practice, but to this of L.'s no objection can be reasonably made on this score in any way, either on the whole or in detail, for it is very plain that there is nothing complex about it; some may object to the wires passing under ground as likely to be torn up spitefully—stuff!—why are not the gas or water pipes torn up for "spiteful sport?" Or they may object to there not being a sufficient quantity of electricity to be had, when required to discharge the letters of a long communication; to this I answer, firstly, long communications are never required or sent by telegraphic dispatches; and secondly, if they do happen to be long, a good galvanic battery will always keep accumulating a sufficient quantity, which can be collected in the usual way: and thirdly, they must not suppose that the machine is to be always working, like a Cornish steam-engine, and therefore a constant quantity of electricity will not always be required; therefore, there will be plenty of time to collect electricity to any extent. Had this machine been brought out by an F.R.S., C.E.F.S.A., &c., it would have made as much noise, and attracted as much attention, as any of them; and I would advise L. to persevere, and keep a sharp look-out for smugglers, for some people think that F.R.S. attached to their name gives them an undoubted right to pirate the beauties of a machine invented by an unfortunate "unknown," and force them on the world as their invention; this has been, and is done in the present day; and a poor, but open-hearted inventor, who has no desire to mystify the public, cannot be too quick in looking after his own rights, as some of these F.R.S.'s are not so exactly correct as they should be.

I am, &c.
TYRO LOCK.

## ANSWERS TO THE QUESTIONS IN No. 52.

QUESTION V.

*Can a Man see his own Face?*

YES; and its antipodes too, if he looks in the glass. This, though the accurate answer, is the one we should expect from an uninformed person; if the same question could be proposed to a vestry meeting, they would probably declare almost unanimously, that a man does not see his own face, but its reflection, or image, &c.; this is *ratiocinatio verbosa*, or reasoning upon words instead of things; a very great, though very common fault with too many reasoners. Sight is a sensation caused by the action of light, which proceeds from luminous bodies, and passing through the refracting media of the eye, forms an image of the object we contemplate, upon a surface endowed with that sensibility which enables us, with the aid of constant experience, to distinguish the shape, colour, and to some extent, the size, distance, and direction of the object. It is not essential to distinct vision, that the rays should proceed in a right line from the object to the eye; when the sun, or any other celestial body, appears on the horizon, it is really considerably below it; the atmosphere refracting the rays downwards to our eyes. Also when a ray falls upon a polished plane surface, its direction is changed: but *the identical ray emitted from the object is incident upon the eye*, that is to say, *we see the object*, though its apparent place is altered; because we are accustomed to observe the point which emits the light, in a right line with the incident ray.

Q. E. D.

*Grand Junction Railway.*—Heavy goods are now carried on this line of railway, timber excepted. The conveyance has hitherto been confined to passengers.

Digitized by Google

...ure may be had at any ... The amalgum for the ... may be made of two parts ... one part mercury, well ... ing of a looking-glass ... in and mercury, and as... for the purpose. One of ... difficulties in constructing a ... suggested by your correspon... making a hole in the ... which is to serve as ... altogether unnecessary, ... is held carefully in ... cavity at the bottom ... melted sealing-wax is ... stick is well surrounded, ... sealing-wax cooling, ... quite firm. This is the ... in my machine, and ... serves very much, it ... down: the spindle at ... may be fixed in a cork ... very tightly; be careful ... opposite each other ...

... am, Sir,

... obedient servant.

F. H.

## ...ING EXPERIMENT.

... a florence flask with water; ... over a lamp, and let it boil for a ... minutes: then cork the mouth of the ... as expeditiously as possible, and tie ... moist bladder over the cork, to ... the air. The water being now ... from the lamp, the ebullition will ... cease: but may be renewed by pouring ... water gradually upon the upper part ... the flask; but, if hot water be applied, ... boiling instantly ceases. In this manner the ebullition may be renewed and again made to cease, alternately, by the mere application of hot and cold water.

The theory is this:—water boils at 212 degrees, under the common pressure of our atmosphere; now, if the atmosphere, or a part of it were removed, the pressure on the surface would be less, and the consequence would be that water would boil at a much lower temperature; and this leads us to an explanation of what takes place in the foregoing experiment. We fill a flask half full of water, and boil it for a few minutes over a lamp; the steam which rises forces out the atmospheric air, and occupies its place; we then remove the lamp and secure the flask so as to prevent the readmission of atmospheric air. If cold water be poured over that part of the flask occupied by the steam, the cold

Digitized by Google

water will condense it, which will trickle down the sides of the flask, and mix with the liquor below; the steam being thus condensed, a vacuum is formed above the surface. The water then having no pressure of atmospheric air or steam, commences boiling afresh; but if hot water be now poured upon it, the steam again occupies the surface and the boiling ceases.

JEAN E***G.

## INTERESTING EXPERIMENT.

*To the Editor of the Penny Mechanic.*

SIR,—I beg to send you the following very interesting experiment in electricity. Take half a sheet of writing-paper and hold to the fire, and make it as hot as possible; then lay it immediately on another sheet of paper, and rub it briskly with a piece of India-rubber for a few seconds, and it will be very strongly charged with electricity, and will adhere to the sheet of paper on which it is laid, as though it were actually pasted on it, and if drawn off very carefully, strong electrical sparks will be distinctly seen, accompanied with a strong rustling noise; it will very powerfully attract any small particles of light matter, and make them jump and dance *a la quadrille* if the sheets are held directly over each other, and the particles placed between them. If a strong coarse sheet of brown paper be warmed and briskly rubbed with a woollen cloth it will be very powerfully charged, especially if the paper be made very hot by holding it to the fire. Is it not possible to make a machine from this, that shall rank amongst your "cheap electrical apparatus?" Suppose a sheet of good thick paper were coiled round a non-conducting cylinder, and a proper rubber annexed to act upon it in the usual way, and this machine put in motion and excited before a fire, by which means the most electricity would be generated, could the fluid so obtained be carried to a Leyden phial, and changed by the interposition of good conducting substances in the usual way? I think that sufficient electricity might be obtained this way to perform a few amusing experiments, such as are dispersed through the pages of your valuable little work, without the trouble of knocking out the bottom of wine bottles for this purpose, as recommended by many of your talented electricians. As I am not much acquainted with this subject, I leave the experiment to the more experienced of your subscribers. I am, Sir,

TYRO LOCK.

*Metallurgy.*—The experiments of M. Laurent have led him to believe,—1st. That charcoal is not a fixed body, as hitherto supposed, but that it is capable of emitting vapours at high temperatures; 2ndly. That this is also the case with several other bodies hitherto looked upon as fixed,—such as iron, cobalt, nickel, and their oxides; 3rdly. That the passage of different solid bodies into other solid bodies is not effected by molecules under the influence of an electric current, but by one of them passing in the form of vapour into the pores of the other. M. Laurent imagines that these observations may be usefully applied to metallurgy.—*Athenæum.*

*To Extract and Preserve the Red Colour of Cabbage.*—Digest the leaves of the cabbage in warm alcohol, and when the whole of the colouring matter is extracted, distil off a portion of the spirit, and evaporate the remainder at a very gentle heat to the consistence of a syrup. This extract may be preserved unimpaired for years, if kept in phials closely stopped. To use it, add a small portion of it to water, when the addition of an alkali or acid will produce its peculiar effect. To employ this test to detect small quantities of carbonic acid, add to it a little diluted alkali, which will make it green; and the acid, by neutralizing the alkali, will restore the blue colour. Test papers may be prepared by means of this alcohol tincture of the cabbage, which, when rendered green by immersion in a diluted alkaline solution, may be used in all those cases in which litmus papers are commonly employed.

*Water a bad conductor of Heat.*—Pour a little sulphuric ether on the surface of a glass of cold water, and set fire to it. The ether will burn for a considerable time, producing a large volume of flame; but when it is extinguished the water will be found not to have been at all heated. This shows that water will not convey heat downwards, and that if we want our kettles to boil, heat must be applied at the lower part.

*Destroying Fire-Damp.*—We understand that Mr. Charles Burrows, mason, of St. Austin, after studying many years the best method of destroying damps in coal-mines, which have proved fatal to so many thousands of human beings, has at length succeeded in constructing a machine which will effectually destroy them, and enable the miner to prosecute his work with the aid of a lighted candle, without la[illegible] or any covering, in perfect saf[illegible] *Briton.*

Digitized by Google

# THE CHEMIST.

## GARDEN FOUNTAIN.

(See Fig. 1. Front Page.)

*To the Editor of the Penny Mechanic.*

Sir,—The following section of a fountain for a garden or other places, consists of a cylinder truly bored containing a large pipe A (which descends nearly to the bottom of the cylinder), withinside of which is a smaller tube B. The action of the water is occasioned by the moveable piston C C, and the weights D D. The water is forced up the large pipe, and then, by the elasticity of the air, it is forced up the smaller one, and to a considerable height.—The horifice at E should be very small.

I remain Yours, &c.

J. Hilton.

## ELECTRICAL MACHINE.

(See Figs. II. and III. Front Page.)

*To the Editor of the Penny Mechanic.*

Sir,—Some time back I promised you an account of a simple electrical machine I had constructed; as, however, you have received several communications on the same subject, I shall merely mention one advantage my machine possesses over those of your correspondents; which is, the rubber being supported on glass, we are enabled to obtain the negative spark from it, as well as the positive spark from the conductor, by means of which a number of important experiments may be performed, which could not be without; this is managed simply as follows:—The rubber is glued to a piece of wood, which is inserted in the neck of a small phial, as shown at A, fig. 2, and secured by sealing-wax. A piece of leather is tied tightly near the bottom of the bottle, at back, as at B, the end of which is nailed to the stand to secure it as a hinge; in front of the bottle is tied a piece of India-rubber, the end of which is also made fast to the stand as at C; so that you see when the rubber is pressing against the cylinder, the elastibity of the India-rubber permits the cushion to yield to the inequalities of the cylinder, and the pressure is always nearly equal. D represents the cylinder: a knob or piece of bent wire must be fixed in the back of the rubber to receive the spark from. If the cylinder is made of green glass, the positive spark is given out by the rubber, and the negative by the conductor; but if of white glass, the contrary. My cylinder is of white glass—a common sample phial, holding about three-quarters of a pint; such a one may be had at any phial shop for 3d. The amalgum for the rubber and flap, may be made of two parts zinc or tin foil, and one part mercury, well mixed. The silvering of a looking-glass is composed of tin and mercury, and answers very well for the purpose. One of the greatest difficulties in constructing a machine as directed by your correspondent F. E. X., is making a hole in the bottom of the bottle which is to serve as a cylinder: this is altogether unnecessary, for if a piece of wood is held carefully in the centre of the concavity at the bottom of the bottle, while melted sealing-wax is dropt in until the stick is well surrounded, as in fig. 3, on the sealing-wax cooling, it will be found quite firm. This is the way it is done in my machine, and although I have used it very much, it has never broken down; the spindle at the other end may be glued in a cork fitting the neck very tightly; be careful to get the spindles opposite each other and in the centre.

I am, Sir,

Your obedient servant.

Bishopsgate St. F. H.

## AMUSING EXPERIMENT.

Half fill a florence flask with water; place it over a lamp, and let it boil for a few minutes; then cork the mouth of the flask as expeditiously as possible, and tie a slip of moist bladder over the cork, to exclude the air. The water being now removed from the lamp, the ebullition will cease; but may be renewed by pouring cold water gradually upon the upper part of the flask; but, if hot water be applied, the boiling instantly ceases. In this manner the ebullition may be renewed and again made to cease, alternately, by the mere application of hot and cold water.

The theory is this:—water boils at 212 degrees, under the common pressure of our atmosphere; now, if the atmosphere, or a part of it were removed, the pressure on the surface would be less, and the consequence would be that water would boil at a much lower temperature; and this leads us to an explanation of what takes place in the foregoing experiment. We fill a flask half full of water, and boil it for a few minutes over a lamp; the steam which rises forces out the atmospheric air, and occupies its place; we then remove the lamp and secure the flask so as to prevent the readmission of atmospheric air. If cold water be poured over that part of the flask occupied by the steam, the cold

Digitized by Google

water will condense it, which will trickle down the sides of the flask, and mix with the liquor below; the steam being thus condensed, a vacuum is formed above the surface. The water then having no pressure of atmospheric air or steam, commences boiling afresh; but if hot water be now poured upon it, the steam again occupies the surface and the boiling ceases.

JEAN E***G.

## INTERESTING EXPERIMENT.

*To the Editor of the Penny Mechanic.*

SIR,—I beg to send you the following very interesting experiment in electricity. Take half a sheet of writing-paper and hold to the fire, and make it as hot as possible; then lay it immediately on another sheet of paper, and rub it briskly with a piece of India-rubber for a few seconds, and it will be very strongly charged with electricity, and will adhere to the sheet of paper on which it is laid, as though it were actually pasted on it, and if drawn off very carefully, strong electrical sparks will be distinctly seen, accompanied with a strong rustling noise; it will very powerfully attract any small particles of light matter, and make them jump and dance *a la quadrille* if the sheets are held directly over each other, and the particles placed between them. If a strong coarse sheet of brown paper be warmed and briskly rubbed with a woollen cloth it will be very powerfully charged, especially if the paper be made very hot by holding it to the fire. Is it not possible to make a machine from this, that shall rank amongst your "cheap electrical apparatus?" Suppose a sheet of good thick paper were coiled round a non-conducting cylinder, and a proper rubber annexed to act upon it in the usual way, and this machine put in motion and excited before a fire, by which means the most electricity would be generated, could the fluid so obtained be carried to a Leyden phial, and changed by the interposition of good conducting substances in the usual way? I think that sufficient electricity might be obtained this way to perform a few amusing experiments, such as are dispersed through the pages of your valuable little work, without the trouble of knocking out the bottom of wine bottles for this purpose, as recommended by many of your talented electricians. As I am not much acquainted with this subject, I leave the experiment to the more experienced of your subscribers. I am, Sir,

TYRO LOCK.

*Metallurgy.*—The experiments of M. Laurent have led him to believe,—1st. That charcoal is not a fixed body, as hitherto supposed, but that it is capable of emitting vapours at high temperatures; 2ndly. That this is also the case with several other bodies hitherto looked upon as fixed,—such as iron, cobalt, nickel, and their oxides; 3rdly. That the passage of different solid bodies into other solid bodies is not effected by molecules under the influence of an electric current, but by one of them passing in the form of vapour into the pores of the other. M. Laurent imagines that these observations may be usefully applied to metallurgy.—*Athenæum.*

*To Extract and Preserve the Red Colour of Cabbage.*—Digest the leaves of the cabbage in warm alcohol, and when the whole of the colouring matter is extracted, distil off a portion of the spirit, and evaporate the remainder at a very gentle heat to the consistence of a syrup. This extract may be preserved unimpaired for years, if kept in phials closely stopped. To use it, add a small portion of it to water, when the addition of an alkali or acid will produce its peculiar effect. To employ this test to detect small quantities of carbonic acid, add to it a little diluted alkali, which will make it green; and the acid, by neutralizing the alkali, will restore the blue colour. Test papers may be prepared by means of this alcohol tincture of the cabbage, which, when rendered green by immersion in a diluted alkaline solution, may be used in all those cases in which litmus papers are commonly employed.

*Water a bad conductor of Heat.*—Pour a little sulphuric ether on the surface of a glass of cold water, and set fire to it. The ether will burn for a considerable time, producing a large volume of flame; but when it is extinguished the water will be found not to have been at all heated. This shows that water will not convey heat downwards, and that if we want our kettles to boil, heat must be applied at the lower part.

*Destroying Fire-Damp.*—We understand that Mr. Charles Burrows, mason, of St. Austin, after studying many years the best method of destroying damps in coal-mines, which have proved fatal to so many thousands of human beings, has at length succeeded in constructing a machine which will effectually destroy them, and enable the miner to prosecute his work with the aid of a lighted candle, without lantern or any covering, in perfect safety.—*West Briton.*

Digitized by Google

# INSTITUTIONS.

## LECTURES DURING THE WEEK.

*Tower-street Mutual Instruction Society*, 16, Great Tower-street.—Feb. 19, Mr. Robinson, on Meteorology.

*Southwark Literary Society.*—Feb. 21, T. J. Serle, Esq., on Shakspearian Readings.

*Hall of Science*, Commercial Place, City Road.—Monday Evenings, at half-past eight, J. C. Coombe, on Chemistry.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Can any of your readers inform me of the best method of procuring Oil Gas? A. T. R.

SIR,—Will any of your readers inform me what chemical preparation, rubbed on the hands, will resist heat? J. E.

SIR,—Will mercury, dissolved in nitric acid, make nitrate of mercury; if not, will some one be kind enough to inform me how I can make it?—What is the British plate composed of?—How is sulphate of copper made?—Which is the easiest and best way to cast zinc, brass, or lead cylinders, open at both ends? D. J.

SIR.—Having occasion in the course of my avocation to find the value of different commodities at different prices, and it being very tedious to work by the old rules, I am in the habit of finding the average price, and afterwards calculating the whole value at that price. I was surprised to find my usual plan fail in the undermentioned example. I shall feel obliged if your highly-talented correspondent "Q. E. D." will account for the said failure.

| Lot | Cwt. | qr. | lbs. | | s. | d. | | £. | s. | d. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 20 | 2 | 14 | at | 8 | 6 | .. | 8 | 15 | 3¾ |
| 2 | 20 | 1 | 7 | — | 5 | 6 | .. | 5 | 11 | 8½ |
| 3 | 24 | 2 | 4 | — | 3 | 4 | .. | 4 | 1 | 9¼ |
| | 65 | 1 | 15 | | | | | 18 | 8 | 9½ |

Average Price..... 5 9½

I am Yours, &c.

O. P. Q.

SIR,—Can any of your Readers inform me whether there is an institution in the parish of Mary-le-bone similar to the City of Westminster Literary and Scientific Institution? A. B.

SIR,—Can Mr. Watts, or any other of your numerous readers, inform me how to obtain the skeletons of small animals, from the size of a mouse to that of a goat? An early answer will greatly oblige as I have a small goat skinned, and I do not know how to proceed.

Yours, &c.,

FORMATOR.

## ANSWERS TO QUERIES.

Answers to Queries in No. 66.

Que. 1. "*Is there anything that attracts silver in the same manner that the load-stone attracts steel?*"

All metals are capable of acquiring some degree of polarity, but no substance will attract silver *in the same manner as the magnet attracts steel.* The most powerful attractions of silver as well as gold, are the following: 1st. the budget in England; 2nd. Lewis Phillippe in France; 3rd. the flying Dutchman in North America; 4th. Jews and Scotchmen throughout the world.

Que 2. Let the mustard seeds be soaked in water till they are ready to burst; then place them on a wet flannel, in a warm situation, and in less than two hours you will obtain a small sallad. By means of electricity, the vegetative process might, doubtless, be accelerated; but the above experiment is sufficiently remarkable to render it highly interesting.

Q. E. D.

For the information of "C. W.," in No. 65, I beg to say that I have always found naptha (which is the menstruum in which India-rubber is dissolved), entirely removes the India-rubber from the pores of the skin, after using the solution thereof.

F. E. L.

SIR,—In No. 65 of your valuable work, is an article headed "The Elements, No. 3," &c., and signed "Apollo Chemicus," in which, amongst other things, is the following extract. "*Iodine*, bromine and fluorine, are similar in their properties to chlorine; though not so important. The two former, *i. e* iodine and bromine, exists in *sea water*," &c. I beg to inform "Apollo Chemicus," and the readers of your work, who are not acquainted with the fact, that he is in error, for iodine does not exist in sea water, but in sea weed, the source from which it has only been obtained up to the present time.

I am, Sir,

Your very obliged and obedient Servant.

C. PARKE.

"C. Parke," Fluor spar can be purchased at Palmer's, 103, Newgate Street, Price 4*d.* per lb.

"J. C. A." How to make Blue Lights.—See Penny Mechanic, Nos. 37 and 39.

"W. B." How to make Alum Baskets.—See Penny Mechanic, No. 46.

F. E. L. *To make paper Gas-proof, for air balloons.* See No. 53, Penny Mechanic.

"A. T. R." can purchase Earthenware Retorts from 8*d.* to 10*d.* each, at Palmer's, 103, Newgate Street. Also every other article he has named. He must try again at the method proposed for making magnets; his metal must have been bad.

SIR,—I send you herewith a specimen of tracing-paper; the lines upon it are India-ink, drawn with a steel drawing-pen; which I prepare as follows:—Put four ounces of Flanders-glue, and four ounces of white soap into a saucepan, with one pint of water, dissolve them on a slow fire, then, add two ounces of powdered alum, and strain it through muslin. Use it cold with a sponge or pencil. A. M.

## TO CORRESPONDENTS.

H. B.'s *paper on co ustion will not suit our columns. We are sorry to see so much soreness displayed in different quarters because a gardener has discovered in the dark, what the scientific have been in vain looking for in broad day-light.*

*In our next we shall give an account of the inaugural meeting, held at Exeter Hall, of the "Society for Promoting Practical Design among the People."*

J. W.'s *communication came too late. We have an Engraving in hand.*

*We have seen the velocipede referred to by our correspondent* H. A., *and, like all others bearing that name, performs most admirably* down hill. *Should our friend, however, construct one for his own use, we would advise him, on approaching an inclined plane, (if he wishes to make light work of it) to follow the example of the old man and his donkey.*

J. Goddard. *The parts of the* Penny Mechanic *will in future be ready at the end of the month, so as to be delivered with the Magazines.*

T. E. H. *It ought to have read, oxy-hydrogen* blow-pipe. *The article appeared in* No. 58.

J. B. *A piece of whipcord, fastened to the spring of the bell would answer every purpose.*

*Received* Theta.—Alfred Clark.—A Friend to Science, &c. &c.

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,

## AND THE CHEMIST.

Nos. LXX. & LXXI.] SATURDAY, FEB. 24, 1838. [*Price 2d.*

### PLAN FOR GUIDING BALLOONS.

FIG. I.

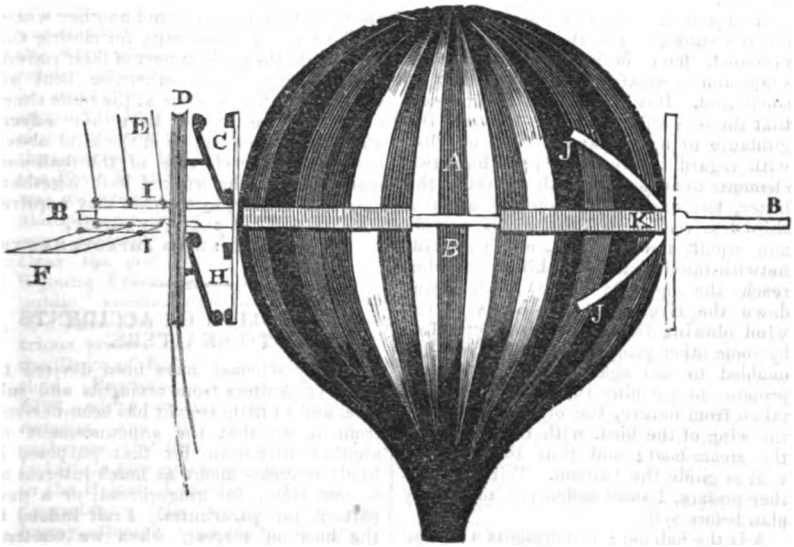



FIG. II.

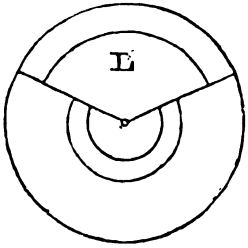
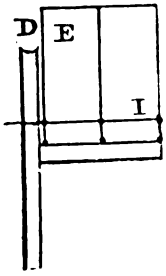



FIG. III.






Holloway Press: D. A. Doudney.

Digitized by Google

## PLAN FOR STEERING BALLOONS.

SIR,—It appears strange that in this age of invention no plan has yet been found out for the guidance of balloons. I confess that I have not inquired much into the subject, neither do I pretend to understand the management of balloons, or to dictate to those who do; but still one may be able to suggest an idea which might be improved, perhaps, to some advantage.

It appears to me, so far as I have read on the subject, that the plans hitherto proposed, have been by changing the shape and by affixing a helm and flags of some kind. But it should be remembered that there is this difference between the guidance of a ship and a balloon; that with regard to the former, you have two elements to assist you, with respect to the latter, but one. Endeavour to guide a ship deprived of its sails across a wide and rapidly flowing river, and you will, notwithstanding all your skill at the helm, reach the opposite shore much lower down the river; but by means of the wind blowing in a contrary direction, or by some other propelling power, you are enabled to sail against the current. I propose to combine two principles; one taken from nature, the other from art—the wing of the bird, with the paddle of the steam-boat; and thus to propel as well as guide the balloon. Without further preface, I shall endeavour to lay my plan before you.

A is the balloon; B represents a sliding rod made to pass through the balloon, and to shorten or lengthen according as the balloon may be more or less distended; C is a kind of wheel or plate fixed to the sides of the balloon by means of some crossed springs, represented by J, J, J, J, meeting in the centre K; the plate C is also fixed to the sliding rod B, so that it is motionless. The plate C is better represented by fig. 2, the parts L L being raised for the balls at the ends of G and H to work against; D is a wheel working on the end of the sliding rod B, and better represented by fig. 3; E represents one of the sails (of which there may be four, five, or six, as may appear best) open to strike against the air. It is composed of three or four rods connected by means of joints with the cylindrical part of the wheel D, as in fig. 3, and covered with cloth or canvass of any description; F represents the sail partially shut or closed so as to turn round without striking the air; G and H are the instruments for opening and shutting the sails; they are short rods with balls at each end; these balls work upon the raised parts of the plate C, or fig. 2. The rods G and H are fixed to the wheel D by means of raised joints as at M, M; J, J, are strong wires joined to the rods G and H with a joint, and joined also to the several rods which compose the sail by joints, so that in the position G of the small rod, the sails will be open to the air, and in H closed, or lying in a line with the sliding rod B. The wheel D is to be turned round by means of a band or line passed round it and round another wheel in the car. The necessity for closing the sails while they take a part of their round, is, that they would otherwise beat all ways or in all directions at the same time, and therefore would have no effect. There must be a paddle of the kind above described on each side of the balloon, made either to be worked both together, or one at a time, as the case may require.

I am, your's truly,
A FRIEND TO IMPROVEMENTS.

## PREVENTION OF ACCIDENTS TO SKAITERS.

So many schemes have been devised to preserve skaiters from accidents and suicide, and so little benefit has been derived from them, that the announcement of another invention for that purpose, is likely to create about as much interest as a new stamp for gingerbread, or a new pattern for parachutes. Frail indeed is the hope of success, when we contend against the follies of mankind; but no consideration will justify the relaxation of our utmost efforts, when the evil we have to combat, is in its consequences so afflicting, and so desolating as this perverse and deplorable passion, which must be gratified even in the jaws of death. How many bright eyes, beaming with pleasure, and the etherial joy of unclouded hope, have been plunged into the gloom of hopeless grief, by one fatal crash, turning the gay waters of our parks into a cruel and untimely grave; how many scenes of buoyant hilarity and thoughtless mirth have given place to funeral moans, and the shrieks of despair?—and all this desolation is to be suffered, because certain gentlemen think it necessary to slide about in pattens, and respectable females deem it consistent with propriety to mimick such anticks. All these evils might be avoided without inconvenience to any rational being; and it is extremely wrong that such a state of things should be tolerated.

Digitized by Google

The remedy I propose, is this; let a certain number of fire-engines, according to the extent of the surface to be protected, be placed at convenient distances round the ice infested with skaiters; then, public notice being given, the nearest engine is to play upon the first intruder, and if he or she proceed beyond its rear, another engine may continue the operation, pumping without intermission till the patient abandons the ice. Should the ice be invaded by a large concourse of people, one powerful engine would, with proper management, disperse several thousands; and the water falling upon the ice, would render the surface so uneven that it would be unfit for skaiting. This plan was adopted in 1832 by M. Lobau, to quell the riots which were so frequent in Paris at that period. It was first introduced in the Place Vendôme, where a great crowd was collected for the purpose of making a disturbance; although many thousands were assembled, one engine sufficed to clear the place in a very short time; "young France," caught cold, "the republic" sneezed, and the mob dispersed. We have also the testimony of an illustrious prince, His late Royal Highness the Duke of Kent, in favour of this method. Previous to the great eruption of 1793, which covered half Europe with demons, and all England with tax-gatherers, the little territory of Geneva, (which is now united in second marriage to the Helvetic Confederation), was an independant, virtuous, and consequently happy, though somewhat turbulent republic. During the residence of Prince Edward in this microscopic state, frequent broils occurred between the "magnificent lords" (such was the title of the councillors of state) and "the people" who inhabited the lower part of the town. Upon one occasion the demands of the people were of such a nature, that the magistrates resolved to show fight rather than accede to them; an army, fifty strong, was accordingly sent to reduce the rebellious Saint Gervais to obedience; but the will of a nation is mightier than the wrath of a ruler; the bridge was barricaded, and every preparation made for a determined resistence. Under these circumstances, the fire-engines of Saint Gervais were first brought into requisition as instruments of war; hot soap-suds was prepared by patriotic dames, and supplied in buckets to the engines; the soldiers, half blinded by the soap, were soon routed, and the people encouraged by this success, proceeded to the town hall, and compelled the Syndic and his magnificent colleagues to grant the object of their desire. Prince Edward so admired the conduct of the Saint Gervaisans on this memorable day, that he exclaimed, "If I had half a dozen Saint Gervais, I could go round the world;" (je ferais le tour du monde). The "sovereign people" discussed the events of the day over an extra bottle of Beaujolais; the Synetic read Seneca; and the morning sun lighted a contented and dutiful people to their accustomed occupations.

Q. E. D.

## BIOGRAPHICAL SKETCHES.

### Dr. FARADAY.

The subject of the present sketch is perhaps one of the most striking examples of what may be effected by genius and patient industry that the present age affords. The effects of genius in raising, often from the lowest ranks of society, to situations of wealth and influence, those who are so fortunate as to possess the divine gift, might be shown by reference to many individuals of the present day; but it is seldom that obstacles, apparently insurmountable, as those against which Faraday had to contend, have been so successfully overcome. Dr. Faraday was born in 1795, and is therefore now in his forty-third year. His father, who is stated to have been a poor blacksmith, apprenticed him at the age of nine years to a bookbinder, and he continued at that occupation till his twenty-second year. It has been said truly, "there is a tide in the affairs of men, which, taken at the flood, leads on to fortune;" and at this period of his life Faraday appears to have experienced it. He was one day binding some books, when Mr. Magrath, who is now the Secretary to the Athenæum, visited the shop where he was at work and entered into conversation with him. The subject of our sketch, though moving in a humble rank of life, had not neglected the cultivation of his mind, and although not possessing the opportunities for obtaining scientific knowledge, by means of Mechanics' Institutions and cheap scientific works, that every mechanic of our own time can avail himself of, yet he had made himself familiar with more than one of the sciences, and Mr. Magarth was therefore much pleased by his conversation, and surprised to find so much valuable information acquired by a man in his humble situation. But it was in chemistry in particular that Faraday had made the greatest advances; and Mr. Magrath, thinking no doubt that

Digitized by Google

# THE CHEMIST.

## COMBUSTION.

NO. II.

WHEN combustion proceeds with rapidity, and the union of oxygen with the combustible is accompanied with intense chemical action, flame is produced.

For the production of flame two conditions are necessary; first, in all ordinary cases, that oxygen should be present;* and secondly, that the combustible should be raised to a high degree of temperature.

Before proceeding, however, to describe the causes which produce flame, we may briefly notice the manner in which it has been regarded by various nations, at different periods of time. Man appears to be the only animal capable of making fire subservient to his use, and by its means increasing his enjoyment. We know of no animal that produces fire for the purpose of relieving its wants, or, indeed, under any circumstances whatever. Wild animals are terrified by it, and the traveller in the forest knows that his best protection against the ferocious animals that prowl by night, is a blazing fire. Indeed, beasts that have been domesticated, and thus in some manner familiarized with the appearance of flame, avoid it as much as possible; and it is well known that when the stables of a farm-house catch fire, great difficulty is experienced in saving the cattle, in consequence of their being terrified at the appearance of the flame.

As the power of making use of fire seems to be peculiar to man, it is not surprising that it should, in almost every uncivilized country, have been regarded with peculiar veneration. By many of the old philosophers it was esteemed a portion of the divine essence, and connected, in some mysterious manner, with the immaterial principle of man. Hence a flame was constantly kept burning in the temples of the heathen deities, and by some nations was actually worshipped as God; or, at least, as his attribute. In Persia this was universally the case; and the practice was not confined to that nation alone. In every age and country it has been regarded with some degree of awe and veneration. By the uncivilized man it is true it has been more highly prized than by those who have made greater advances in knowledge, but only because, to the former, it appeared more mysterious and wonderful. Both have alike been indebted to it for the greatest enjoyments of life; and if the merit of discovery is to be estimated by the good produced, no man deserved to be regarded with greater honour than the discoverer of the means of producing flame. Probably the fabled Prometheus might be that man.

The identity of light and heat, in various particulars, is a subject that has long engaged the attention of philosophers. In the production of flame the analogy is very striking. If we expose a body—a piece of iron for instance—to a high degree of temperature, it soon becomes red hot, the intensity of its redness increasing with the intensity of the heat applied. If the temperature continue to be raised, the colour of the iron changes, first to a dull yellow, and subsequently, after becoming brighter, to a white heat. In this state the light emitted from it is similar to solar light, with the exception that it will not pass through glass, accompanied by its heat, in the same manner that the former will.

We have stated, that under all ordinary circumstances it is necessary, for the purpose of combustion, that oxygen should be present. This may be proved by a variety of experiments: if we place an inverted glass jar over a candle, in a plate of water, so that the air can neither escape nor enter, in a very short time the candle will be extinguished; and if the air be examined it will be found that its oxygen has disappeared, and that an equal quantity of carbonic acid has been formed. A striking instance that oxygen is necessary for combustion is given at page 83 of our first vol. in describing a process in the manufacture of muslins, &c. They are passed over a *red hot* cylinder; but in consequence of being kept in close contact with it, the atmosphere cannot get between the muslin and the cylinder, and the former accordingly is passed over uninjured. The use of bellows in increasing the brightness of a fire depends simply on their forcing a greater quantity of air, and consequently of oxygen, into the fire than it would otherwise receive; and the use of glass chimneys for lamps and gas burners depends on the same principle; but as we have more to add on this subject than can conveniently be conveyed by this paper, we defer it for another article.

* Flame can be produced in chlorine gas; this is a strong reason for presuming that it is a compound of some body with oxygen.

*Boulder Stones.*—These are blocks of granite, found in several parts of Europe, at a great distance from any granite mountains. To account for their existence in such places has given birth to several geological theories.

Digitized by Google

## EXTRAORDINARY FALL OF THE BAROMETER.

THE following is extracted from a German paper:—"On the 23rd of January, 1824, at Leipsic, the barometer stood at 26° 11′, it having been (says the journalist) only three times as low, namely, in 1799, 1782, and 1783, during the whole of the eighteenth century. On referring to the meteorological journals kept in England and France, we observe, that in both these countries also the barometer stood very low on the same day. By the meteorological diary given in the Quarterly Journal of Science, it appears to have been at 28° 70′; and by the meteorological observations in the *Annales de de Physique et Chimie*, at 30° 71′, being in both cases considerably the lowest of the month, and much below the average of the year. At Paris and Leipsic the wind was S.W.; at Althorpe, in Northamptonshire, W.S.W. and N.W.; and it rained somewhat both at Paris and Leipsic."

## ELECTRICITY.

*To the Editor of the Penny Mechanic.*

SIR,—Being generally in the habit of carrying a small glass seal and a piece of good sealing-wax in my pocket, I often witness a very amusing phenomenon. My profession gives me a great deal of walking; or, I might rather say, walking a long distance home morning and evening, the friction of my trousers pocket, in which I carry the wax and seal, completely electrifies or charges both the seal and wax, and which, as a matter of course, are oppositely electrified, the glass containing vitreous and the wax resinous electricity; and the affinity or attraction of these opposite states are too well known to require description here; but if I use the seal and wax to take an impression, when just come off my journey, and of course when they are fully charged, upon taking the seal from the impression, long filaments immediately follow it. What surprises me is the extreme fineness and elasticity of these threads, which are as minute as those of the silk-worm. When both wax and glass have been highly charged, I have succeeded in drawing them out full a yard long, and folded them up like a silkworm's nest; and I have often amused myself by persuading my friends that I had succeeded in rearing silk-worms that spun red silk. This very simple experiment places in a clear light the celebrated law of Du Fay, which recognizes these two opposite fluids; their laws, &c. will be found in any treatise on electricity. Thus, by two machines, not weighing, together, one ounce, we can illustrate one of the two accepted laws of electricity. The experiment can be made by anybody, as it does not require care, provided the wax is good; common wax, I observe, does not succeed so well. I am, &c.

TYRO LOCK.

*Falling Stones.*—An account has been received from Brazil of the appearance of a meteor of extraordinary brightness, and as large as the balloons used by aeronauts. It was seen for more than sixty leagues in the province of Ceara, and over the village of Macao, at the entrance of the Rio Assu; it burst with a noise like thunder, and an immense quantity of stones fell from it, in a line extending more than ten leagues. The largest portion fell at the entrance of the river, and in various places they pierced through several dwellings, and buried themselves several feet deep in the sand. No human life was lost, but many oxen were killed, and others severely hurt. The weight of those taken out of the sand varied from one to eighty pounds.—*Glasgow Herald.*

*Tubus Calefactus.*—Our attention has been directed, by more than one correspondent, to a method of warming rooms, now exhibiting at the Jerusalem Coffee House. The truth is, that a report on this subject would have appeared two months since in the Athenæum, when the stove, or whatever it is called, was exhibited at the meeting of the Horticultural Society, but that we could only talk after the fashion of the famous bottle conjuror, and announce that some person unknown, by means unknown, professed to warm rooms at a very small cost. We thought it better, therefore, to wait for a short time, and until the mystery was revealed. But the same secresy is observed now that the exhibition is public. We regret this the more, because the discovery, if there be a discovery, is likely to be prejudiced by it. It is absurd to call people together by sound of gong, merely to send the thoughtless away gaping and wondering. It would have been time enough when the parties had secured their interests by patent, and were prepared to explain the mystery and execnte orders. It is hardly necessary to add, that heat may be generated, and the effects exhibited produced in many different ways; and that the value of the discovery depends on the time the heat can be kept up, the height raised to, the cost of the material, and the influ-

Digitized by Google

ence of such combustion on health. For an answer to all these important questions we are to take the word of the projector. Now he may be a very honest man, and we are quite willing to believe that he is so—but projectors are apt to be sanguine. *Athenæum.*

*Effects of Vegetation on Carbonic Acid.* At the British Scientific Association, the the following paper was read by Dr. Dalton :—By numerous experiments made in hot-houses, he found that the quantity of carbonic acid was precisely the same both by day and by night, and was in no respect different in quantity from that of the external air. The idea that vegetation was necessary for the purification of the air, by decomposing the carbonic acid, he considered unfounded; for he calculated that in 5,000 years the respiration of the animals supposed to exist, would only produce ·001 of carbonic acid gas in our atmosphere.

*Fossils at Sausan.*—Further inspection increases the importance of the discoveries of M. Lartet and others, at Sausan, and fresh arrivals from him at the Academy of Sciences in Paris, produce new wonders. They combine the remains of animals, which, in all probability no longer exist in nature, with some which do not appear to differ from those actually in being: the mine is still far from being exhausted, and a more favourable opportunity for the observations of geologists never before presented itself. The bones of the rhinoceros most abound; after these come those of deer, with their horns, and if an estimation may be formed by their size, the remains of a small and elegant species of ass or horse must have been there deposited. New fragments of the *Macrotherium gigans* have come to light, which show that its claws bore a strong analogy to those of the Orycteropus. The bears must have been totally different from any yet discovered; and those bones which belong to an animal called Amphicyon, by M. Lartet, show a strong analogy between it and the dog.—*Athenæum.*

## INSTITUTIONS.

### MECHANICS' INSTITUTION, Southampton Buildings.

*Outlines of Lectures delivered in the Chemistry Class.*—The subject of copper was introduced to the members' notice. It appears that copper, or probably a combination of copper and other metals, were known to the Egyptians; for all the domestic and other utensils are of copper, or its alloys, which have been found in examining the pyramids, and other ruins, by modern travellers. We read in Scripture of brazen gates, images, &c., but iron is never mentioned, and has only been found in comparatively modern ruins. They must have been acquainted also with zinc, for zinc and copper are the compounds of brass. Their copper was manufactured in a tolerable state of purity. The following experiments were advanced: To clean native copper from its oxides, steep it a little time in a diluted solution of sulphuric acid, then rince it in cold water, rubbing it with a soft hair brush, and dry it quickly; it will remain perfectly clean and bright, and fit for the cabinet. Copper and sulphur readily combine when the sulphur is in a state of fusion, emitting both light and heat; the residuum is sulphuret of copper. If a clean knife be put in a solution of sulphate of copper, it immediately becomes coated with copper; the attraction is not so powerful as that of silver and mercury, for the copper, in the former case, is readily peeled off, whilst in the latter, friction cannot remove it, but evaporation will. It dries something like dirty frosted silver.

TYRO LOCK.

### LECTURES DURING THE WEEK.

*Tower-street Mutual Instruction Society*, 16, Great Tower-street.—Feb. 5, Mr. A. Lee, on the Steam Engine.

*Southwark Literary Society.*—Feb. 7, E. Cowper, Esq., on Recent Improvements in Machinery.

## ANSWERS TO QUERIES.

"C. Parke" Fluor Spar can be purchased at Palmer's 103, Newgate-street, price 4d. per pound.

"J. E. Goddard." No. 53 contains a receipt for joining the gores of paper balloons.

## TO CORRESPONDENTS.

A Chemist *had better send the papers to our office, and if found to contain matter of general interest they shall be inserted.*

J. B.'s *Letter on a fire alarum shall appear; though we think the "remedy" proposed, without great care, might prove "worse than the disease."*

Y. Z. *There is nothing new in the plan; gas-stoves have been some time in use.*

Enquirer. *There is an iron rail-road, reaching from Croydon to Wandsworth, which was formed upwards of thirty years ago.*

Received, A Subscriber, Brighton—J. B—A. Z.—G. J. Gordred, Brighton, &c.

London: Printed at the Holloway Press, by D. A. Doundney; where all Communications are to be addressed (post paid); published by Berger, Holywell-street, Strand and may be had of all Booksellers.

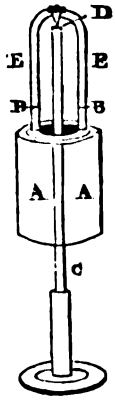
Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LXVIII.] SATURDAY, FEBRUARY 10, 1838. [Vol. II.


### ELECTRO-MAGNETISM.

FIG. I.




### ELECTRO-MAGNETIC ENGINE.

FIG. I.

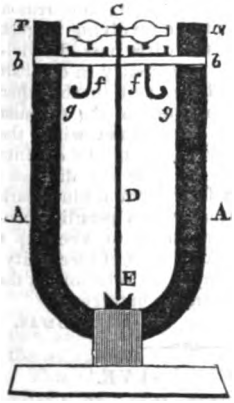



FIG. II.

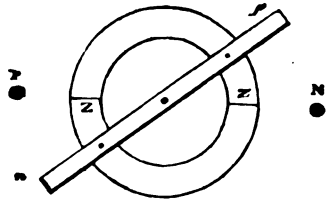
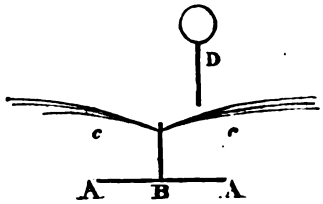



FIG. III.







Holloway Press: D. A. Doudney.



Digitized by Google

## ELECTRO-MAGNETISM.

*To the Editor of the* PENNY MECHANIC.

SIR,—The following is a description (accompanied by a drawing) of an apparatus contrived by Ampere, to show the revolution of the wire round a magnet, which possesses the advantage of containing the trough by which the electric current is produced. Yours, respectfully,

J. R. WATTS.

DESCRIPTION.—Fig. 1—A A, a trough, formed of two cylinders, of very thin copper, about two inches in depth; the outer one about two inches, and the inner about an inch and a quarter in diameter, joined below by a copper bottom. The inner cylinder has a copper wire, B B, fixed to it, so that it can be suspended on a magnet, C, which passes up within it, the suspension being by means of a fine-pointed wire from the bent part, D. Into the trough is placed a cylinder of sheet zinc, which has also a wire passing from one side to the other, E E, and suspended by a pointed wire passing down from the bent part, F, and placed in a small cup, containing a globule of mercury, fixed to the upper part of the bent wire, B B, of the trough. When the trough is filled with diluted acid, and the apparatus suspended on a powerful magnet, the zinc plate revolves in one direction and the copper trough in another, the direction varying according to the pole on which they are suspended. When on the north, the zinc revolves in the same direction as the hands of a watch lying on a table with the dial up, while the trough moves round in the opposite one. If the apparatus be suspended on the south pole the zinc turns in the reverse direction, while the trough goes in the same one with the handles.

## ELECTRO-MAGNETIC ENGINE.

THE principle on which this engine acts is the well-known one, that bodies, positively electrified, attract negative bodies and repel positive bodies. Fig. 1 represents a view of one of the many forms which the apparatus is capable of receiving. A A is a common horse-shoe magnet, having P, its positive, and N, its negative, pole. *b b* is a brass beam, going from one arm to the other, through which D, the rod of C, the electro-magnet works. C, the electro-magnet, is a bar of soft iron, bound round with silk-covered copper wire, two ends of which, one from each pole, are bent downwards, so as to run in a circular trough, F F, filled with mercury, and having two divisions, as hereafter described; from each of which divistons proceeds a copper wire, *g g*, which wires, when the machine is at work, are connected with the two poles of the battery. E is a cup, in which D, the electro-magnetic spindle, works. Fig. 2 represents a view of the circular trough, with the two ends of the horse-shoe magnet, P and N; also the electro-magnet, *n p*: these four letters respectively representing the states of their poles at Z Z. In the circular trough are two divisions, so that the trough is divided into two parts, each filled with mercury, into which dip the two wires previously described, from which mercurial troughs proceed two wires to the battery. Now supposing the battery in action, and the magnets as represented in Fig. 2, the revolving magnet, being negative, is attracted to P, the positive end of the horse-shoe magnet, at the other end the same takes place, when the wires attached to the revolving magnet pass the divisions Z Z, their polarity is changed, and the revolving magnet becomes positive, as well as the permanent one, so that repulsion takes place, and the same also takes place at the negative pole of the horse-shoe magnet, and in this manner by alternate attraction and repulsion the motion is kept up; the reason why the polarity of the revolving magnet is changed when the wires pass the divisions is, because the mercury in one-half the trough is positive, and in the other negative. Fig. 3 represents the division in the trough with the magnet wire; the wire must be sufficiently long to dip into the mercury, and yet pass the division; Every time the poles change a blue spark is seen. The battery is of a peculiar construction, so contrived as to keep up a weak but continued current of electricity; and sulphate of copper, in solution, is the exciting fluid used in the battery.

C. D. THOMAS.

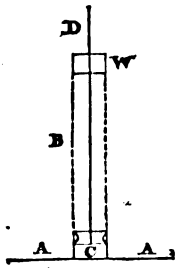
## SAFETY-VALVE.

*To the Editor of the Penny Mechanic.*

SIR,—There is a safety-valve, which does not appear to be so extensively known as its merits deserve, it being decidedly the safest valve yet constructed. It consists of a cylinder or pipe, fixed to the roof of the boiler, and having a series of holes drilled in it. In this cylinder works an air-tight piston, furnished with a rod, by which it is weighted. Now when the force of the steam exceeds the given weight, it will raise the piston, say as far as the first hole, and then escape. If, however, one hole should not be sufficient

Digitized by Google

for its escape, it will raise the piston to the second hole, and so on, till it has a sufficient vent; after which the piston will fall, and prevent the further escape of the steam.




DESCRIPTION.—A A, roof of boiler; B, cylinder, with holes; C, Piston; D, rod; W, weight.

C. D. THOMAS.

## DAVY'S ELECTRICAL TELEGRAPH.

WE have just seen this beautiful invention, now exhibiting at Exeter Hall, and illustrated by interesting experiments, and we shall endeavour to give some account of it to our readers; strongly, however, advising to visit for themselves, one of the first and most useful applications of that most extraordinary and subtle fluid, *electricity*.

If a piece of zinc, and another of copper, be placed near and opposite each other without touching, in a vessel containing an acid, such as oil of vitriol, diluted with water, the two metals will acquire opposite states of electricity. If now a metallic wire of some length be connected by solder, or any very perfect metallic contact with each metal, a current of what is called *voltaic electricity*, or *galvanism*, will constantly flow along each wire, from one end of it to the other.

This electric current possesses magnetic properties, and if the conducting wire be brought close over the needle of a mariner's compass, which points north and south, it will turn it out of its direction, and cause it to point east and west, or vice versa. The wire connecting the zinc and copper may be of very great length; for instance, many miles, and yet it will produce the same effects at any part of it.

If 26 magnetic needles, each bearing a letter of the alphabet, be fixed in as many coils of 26 wires, then on passing the galvanism to any one or other of these wires, the corresponding letter will be given as the signal; and letters may be signalled in succession, so as to form complete words and sentences. This is the elementary form of the apparatus described by a French philosopher many years ago; and a similar imperfect apparatus has recently been exhibiting publicly under a different name. The objections are the vibration of the needles, and the loss of time and liability to mistake, and also the length of space which the needles occupy; and the not having them all at once under view; besides the multiplicity of wires, and the expense. The plan has of course been considered as no way adapted for practice.

Mr. Davy has, by the application of some not generally-known principles, brought the invention to the greatest perfection, as may be believed from the following description:—Instead of 26 wires, Mr. Davy employs only six; and with these he can give upwards of 200 signals, including the 26 letters of the alphabet. Nothing whatever is seen of magnetic needles; there is a small dark screen, on which the letters (either singly, or combined into words, or arbitraries) start into view the instant the key at the opposite end is touched; and this would be the case as instantaneously, even though the wires extended from London to Portsmouth;—the length of distance, according to Mr. Davy's plan, making absolutely no difference whatever. The coming of a communication is always preceded by a sound or alarum; and a bell, struck by the action of a magnet, moved by electricity, separates the letters into words; the bell being rung at any distance by the electricity. The readiness, rapidity, and certainty of this apparatus surpasses all expectation.

This invention requires only to be known to be adopted; its expense, when considered as a public expense, will be a mere trifle, compared with the objects it will effect. It must supersede the common telegraph, and, when general all over the country, it will enable all the country papers to publish the London news as early as the London papers themselves. Possibly it may eventually be taken up by Government as a branch of the Public Post Office.

## FIRE ALARUMS.

*To the Editor of the Penny Mechanic.*

SIR,—Happening to see in one of your Numbers, a proposed method of escaping from a house on fire, by means of "Plummer's Fire Staircase," the idea occurred to me of a method for giving prompt and audible alarm on its commencement, so as

Digitized by Google

to arouse the inmates, and give notice to any watchman who may be casually passing; for it is too well known, from woful experience, that the silent encroachments of an early or recently-commenced fire, rather tends, by its development of stupifying gasses, to prolong the slumbers of the unfortunate inmates, and render them more profound than to awaken them. But by a well-timed alarm, many precious lives and much valuable property might be saved. Now to accomplish this desirable object, I propose that a brass box should be screwed on to such places as over window-curtains, on the tops of bed-posts, or in any situation where a fire is likely to commence from accident or neglect. The box made to be unscrewed in the centre, in order to admit a sufficient quantity of powder to make a good loud report when ignited, by means of the touch-paper, which is to be placed at the end similar to a squib. The points may be of ornamental fancy-coloured touch-paper, when this useful ornament is to be fixed in a smart apartment, &c. Let us suppose that a candle is left on a table, chest of drawers, or some such situation near a window, and the breeze, during the absence of the servant or other person who might have left the light there, to have wafted the curtain within reach of the flame, it is possible that in ten minutes more the destruction of the house would be inevitable, according to circumstances; but if one of the proposed ornaments had been placed there, the alarm of the report might draw attention to the spot in sufficient time to extinguish the flame, or at least to prevent the wainscot, shutters, or ceiling from taking fire.

In any large detached building or manufactory, larger ones might be employed with proper caution, so as to make sufficient report to be heard at any required distance. A sufficient number of these shells might be distributed in different apartments of a house, as well as in outhouses, so as to ensure a speedy alarm in case of fire. Several successive reports might be induced, by placing a cracker in the box; this would, perhaps, be more likely to arouse and give alarm than a single report.

J. B.

[This is rather a *startling* sort of fire-alarum, we must confess. Our correspondent seems to have some faith in the old adage, "Set a thief to catch a thief."]

*Durham and Sunderland Railway.*—This Company intend to create 1000 additional shares, which has met with great support.

## ON THE CRANK.

Sir,—In a letter signed C. D. Thomas, in No. 66 of your publication, it is stated that the crank is the best plan possible for changing a reciprocal motion to a rotary one; but I beg leave to differ with Mr. Thomas on that point, having paid considerable attention to the subject for some time, and at length fixed on a plan that will produce equal power on the whole revolution. At present there appears to be a considerable loss of power, and not attended with a small portion of danger, in certain cases where the engines happen to stop on the centres. My plan will entirely remove all difficulty on this point; but who will undertake to bring it into use, and remunerate me for the trouble I have taken (and which has not been trifling)? I have devoted many months anxiously to it, and have at last rendered it both simple and effective. England, that boasts of her freedom, may also proclaim to the world her laws that prevent the poor man having a patent to insure to him remuneration for the improvements he may be so fortunate as to introduce, and which may prove of the utmost consequence to the community. Let a poor man apply to the authorities for a patent, he will find that nothing of the kind can be had without money. It seems as though our legislators considered the working mechanic quite unequal to the task of thinking, and that improvements can only be made by those persons who may be in affluence.

If Mr. Thomas would wish to inspect a sketch of my plan, I will attend on him any evening he may please to appoint after eight o'clock, at any place within three miles of St. Paul's. I am, Sir, yours, &c.

Jan. 30th, 1838. T. E. M.

*Carriages which do not upset.*—Some experiments have recently been made at Paris with carriages having six wheels, and so fitted up that they can be driven over mounds of three or four feet high without being upset. Five vehicles were attached to a train, and they were drawn rapidly in various directions, turning the sharpest corners, and moving in a circle, and they are reported to have kept their equillibrium so admirably, that, notwithstanding the rapidity of the motion, persons in the carriages can pour out liquids and drink them without a drop being spilled.

The King of Holland, it is said, has refused his sanction to the project for uniting Amsterdam and Rotterdam by a railroad.—*Globe.*

Digitized by Google

## NEW STEAM-ENGINE.

THE "Birmingham Herald" gives a description of a new rotary steam-engine, constructed by a labouring mechanic. "Its size is not more than twice that of a man's hat, and the expense of a five horse-power will not exceed in cost half-a-score pounds. Its form is cylindrical, being about 18 inches in diameter, and 22 deep. The steam is admitted through a hole in a hollow circular belt (attached to a wall), upon which it revolves, and works it by a diagonal action, against an upright piston, being forced out by pressure of a diagonal plate, which divides the interior into two portions. The rotary action is beautifully managed by means of a perfectly spherical steam-tight joint, at the end of a fixed inclined arm, towards which joint the upper and lower surfaces of the interior part of the cylinder are made to slope, after the form of the exterior of an hour-glass. Upon these the diagonal plate performs its revolutions, such movement being permitted through an opening (from the circumference to the centre), equal in width to the thickness of the before-named upright piston, up and down the sides of which it continually works. To the centre of the bottom of the cylinder is fixed a shaft, having attached to it a wheel which communicates the motion that may be required; and this is all the machinery of which it consists!!"

[This is the invention of a labouring man, be it remembered. Now, supposing this discovery should be found of national importance, and no wealthy individual come forward with his purse to procure a patent for him, he must either give up a portion of the profits arising from its sale to some opulent manufacturer who can find the *thing needful*, (and, no doubt, one will be found to join him on these conditions), or he will have the mortification of seeing masters reaping the benefit of his ingenuity, when, perhaps, he is pining away his days in old age, and neglected poverty. Besides, the fact of his making known the particulars of his invention to four persons will preclude him from the right of a patent. We hope before long, to see things better managed, and the inventions of the poor man receive equal protection with those of the rich.]

## GREAT WESTERN RAILWAY.

SOME experimental trials were made on the wide gage, and with the new locomotives, on a small portion of the London end of this line of railway, in the early part of last month, the results of which appear to have been highly satisfactory. A friend of ours, present, writes to us, "I can fully confirm the favourable report in the 'Bristol Mercury,'" an extract from which we subjoin. "Some uneasiness," says he, "it is true, was felt in the motion of the carriage attached to the engine, but this was found to be owing to its springs not having got into play, and the consequent jolting of the body upon part of the framework. Nothing of this was found when riding on the engine itself (generally an uncomfortable post), which shows that the fault was not in the rails. I could stand with one foot on the tender and the other on the engine with ease, without holding by anything, whilst travelling at a rate of nearly forty miles per hour. I should be sorry to try this on any other railway I have yet seen. But, apart from the ease and comfort of the passengers, I cannot but think that even a much greater advantage is secured to the proprietors by Mr. Brunel's mode of construction, in the low cost of maintenance to which this system appears to be liable. There is so little of violence or opposition offered to the passage of the locomotives, even at their highest speed, and the pressure is so evenly distributed over an extensive space at one and the same time, that it appears almost impossible to subject the engines to less strain, or to construct a roadway liable to less derangement. Experience, it is true, is the only thing that will give decisive proof on these points; but I firmly believe that if Mr. Stephenson's estimate of one-third of the receipts for the annual cost of maintenance, &c., should ever be realized (which, as yet, never has been the case), the Great Western Railway will be the first to reduce it to practice."—*Railway Magazine.*

## SOUTHAMPTON RAILWAY.

BY the first of May, we believe, the public may confidently rely on 23 miles of this line being opened to them, as we have before stated; that is, from London to Woking Common. If the weather prove favourable, we have reason to believe it might be very well opened a month or two earlier; but the Directors have prudently resolved not to commit the fault of opening too soon. The line to Kingston, we understand, is completed.—*Railway Magazine.*

Digitized by Google

# THE CHEMIST.

## COPPER.

This metal is a very common source of poisoning, inasmuch as it is continually employed for culinary purposes. It is very remarkable, yet no less true, that as the science of gastronomy has advanced, the various salts of this metal (each of which be it remembered is poisonous) have been more called into requisition. Thus we see that to give pickles a certain delicate green, they are kept in copper jars, not in the least protected with tin. The action of the acid upon these jars produce an acetate of copper, or verdigris. In preserves we see the same dangerous error again fallen into. Fruits, containing certain acids, as citric, mallic, &c., act in the same manner (though perhaps not in so great a degree) as the vinegar of the pickles. The same effect is produced in the cooking of animal food in saucepans of this metal; the oil, or fat, of the meat usually contains an acid called the sebaccic, which also forms an injurious salt with copper. All culinary vessels made of this metal should have a coating (never mind how thin) of tin, to preserve its contents from immediate contact with the copper; a piece of iron, if continually kept in the vessel, will prevent, to a very great extent, the action of acids upon it, but it being coated is far better. Some persons think if the pot, or pan, be repeatedly scoured and kept clean and bright, that there will be little or no danger; but this, we can assure them, makes but a small difference.

Copper, however, appears to us in some other forms than those just mentioned; as for instance in ink, where it is sucked in so deliciously by the school-boy. It is also employed on gilt ginger-bread, and various other ways.

*Tests for the discovery of its presence.*

1. To the liquid supposed to contain it add a little prussiate of potass, and it will, if present, become brown.

2. Add a little arseniate of potass, and a beautiful green will be produced, known by the name of Scheele's mineral green.

3. Add ammonia, and a beautiful violet will be seen.

4. If a piece of polished iron, such as the blade of a pen-knife, be immersed in the liquid, and allowed to remain therein a short time, it will be covered with a thin film of copper.

5. The same effect is produced on polished steel, or clean iron-filings.

### PRUSSIC ACID.

Little need be said upon the nature or effect of this well-known dangerous poison, which can generally be detected by its peculiar smell, resembling bitter almonds. It may be tested with pure potass in solution, to which must be added a little sulphate of iron, which will turn it blue; or sulphate of copper, which will produce a brown colour.

W. Burbridge.

## NITROUS OXIDE; OR, LAUGHING GAS.

The establishment of Temperance Societies, and the general diffusion of teetotalism, would appear, at first sight, to have little to do with nitrous oxide gas; but when the inefficiency of the efforts of these tea-drinking companies, for the suppression of a growing evil, are considered, a *spirit* of philanthropy, actuated by the fact, suggests a more pleasant and considerably less objectionable plan for putting down the evil, in the shape of nitro oxide gas, which produces none of those injuries arising from ordinary fuddling,—such as head-ache, indigestion, and its train of bad consequences,—but, on the contrary, a pleasurable sensation, infinitely superior to any other, as confirmed by the evidence of Sir H. Davy, Mr. Priestley, Mr. Southey, and others; these too, without making a cistern of the stomach, or running any risk of being fined 5s. for drunkenness. Having said thus much I shall now state what I have recently seen and experienced at a meeting of amateur chemists. The gas was made in the way described in No. 46 of The Penny Mechanic. The first person who inhaled it was a young man of a naturally vivacious turn, and his exhibition excited no little amusement; his pugilistic efforts were indiscriminately levelled at all in quick succession, alternated with bursts of laughter. The second person was of a different temperament—though none the less amusing—he had not much tendency to muscular action—at least as compared with the first. Before he had finished taking the gas, his feet began to move involuntarily, and his head to shake; but when he had done, his skeleton-like figure danced like an Italian's monkey under torture. Shaking a head with a profusion of long hair conveyed to the beholders a most ludicrous appearance. Another person who took it manifested an inclination for rolling on the floor, accompanied, as with the others, with fits of laughter. Several others inhaled the gas, and on all was experienced similar results. The effect on myself was

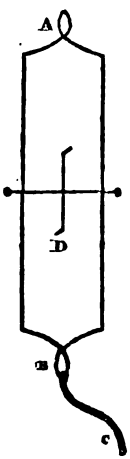
Digitized by Google

singular, first a giddiness with a heated sensation in my head, accompanied with a highly pleasurable feeling, with a sense of weight at my chest; at this time I became unconscious, and on recovering, found my arms akimbo, having given my friends (as they say) no inapt idea of Buonaparte's musing on the sea-shore. If the above remarks are at all calculated to convert the tap-room into a laboratory, or spirits into fuel for making nitro oxide gas, I shall think a good end answered.

*Brighton, Jan.* 24. CHEMICUS, JUN.

## ELECTRICITY.

*To the Editor of the Penny Mechanic.*




SIR,—Every thing which tends to render certain facts manifest by easier and less expensive means than have been previously employed, must be an improvement; and in the construction of all kinds of philosophical apparatus too much attention cannot be paid to this point.

In experiments with the electrical machine a small piece of apparatus is sometimes used to show the force with which electricity is given off by points, in which a wheel is made to roll along two wires stretched on glass pillars, and is called an inclined plane. This, if purchased of the philosophical instrument makers, is an expensive toy, and even if constructed by yourself, would occupy several hours to do it in the roughest manner. I remember reading a short time since (in a work in which electricity was treated of, but where, at the present moment, I cannot exactly recollect) of a plan for an inclined plane of very simple construction, and thinking it would not be unacceptable to your numerous readers, have sent a sketch and description of it.

This inclined plane is formed from one piece of wire bent to the form represented in the annexed drawing (the two ends of the wire should be soldered together) and attached at A by a small hook to the prime-conductor of the machine, the other end B is held in the hand by the silken cord C; place on it the wheel D, and slightly incline the wire, and you have an excellent inclined plane.

SCIOLISTERUS.

## AN ELECTROMETER,

*Used for the detection of the presence of Electricity.*

A VERY good one may be made by notching a 4 oz. glass phial with a file, and then leading a red-hot iron first to the notch, and then gently round the phial, as the crack extends: by this means, the bottom of the bottle is cut off. Then paste two slips of tinfoil or gold leaf opposite each other, inside the bottle, and through the cork thrust a ball and wire, with two slips of gold leaf suspended from it; the bottle may then be fitted into a piece of wood. ELECTRON.

## INCOMBUSTIBLE THATCH.

IT has been proved by repeated experiments, that straw, saturated with a solution of lime, or common whitewash, is incombustible. This fact is of great importance to the rural population, especially as thatch is thus not only rendered fireproof, but much more durable. A solution of alum has been tried, but being soluble, the rain destroys its virtues.—*Railway Magazine.*

Digitized by Google

# INSTITUTIONS.

LECTURES DURING THE WEEK.

*Tower-street Mutual Instruction Society*, 16, Great Tower-street.—Feb. 12, Mr. Sherman, on the beauties of Dramatic Poets.

*Southwark Literary Society.*—Feb. 14, A. B. Granville, on Egyptian Mummies.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Having occasion to use plate-powder very often, such as that sold in boxes at 1s. each, I should feel extremely obliged to you, or any of your Correspondents, by informing me how I can manufacture some. A SUBSCRIBER.

SIR,—Could any of your intelligent Correspondents inform me how I can prepare tracing paper?
CONSTANT READER.

[See No. 30, Penny Mechanic.]

SIR,—Can you or any of your numerous readers inform me the best way to take grease out of paper.—Also, how to make indian-rubber glue? JEAN

*Electrical Shock from a Cat.*—The electricity excited upon rubbing the back of a cat is well known, as well as that it is rendered evident by a snapping noise and sparks of light, but I believe it is not so generally known that an electrical shock can be obtained in nearly the same manner. It can, however, be done as follows:—Take a cat—if a black one all the better—and having well warmed her back before the fire, make her sit on your knee; then place your left hand under her throat, with the middle finger and the thumb gently pressing the bones of the animal's shoulder, at the same time pass your right hand along her back, and slight electrical shocks will be felt in the left hand; and again, if the right hand be placed under her throat, whilst the left rubs her back, the shocks will be felt in the right hand. I have performed the foregoing experiment many times lately, but could never make out the *rationale* satisfactorily to myself. Perhaps one of your able Correspondents, "Z. Wigo," or "Electron, Jun." would be so kind as to investigate the matter, and favour us with an article on the subject.
H. H. CLARK.

## ANSWERS TO QUERIES.

SIR,—I beg leave, through the medium of your Magazine, to answer the query put by one of your Correspondents, respecting the difference in power between a six-feet and a twelve-feet wheel of the same weight. He states he has a wheel six feet in diameter, of such a weight, working so much machinery. Now (allowing the wheel to be a lever-wheel*) twice this quantity of machinery could be worked with a twelve-feet wheel, with the same power and with the same ease as the machinery worked by the six-feet wheel, but with only half the velocity; therefore, if he wishes to have the same power, together with the same velocicity, the man or power must turn the large wheel as many times as he would turn the little wheel, thereby turning the large wheel with twice the velocity (that is, with twice the number of feet per second or minute), and consequently with not so much ease; in one word, if you gain power you lose speed, and if you gain speed you lose power.
CONSTANT READER.

*Speculum.*—Mr. Edwards affirms that different kinds of copper require different doses of tin to produce the most perfect whiteness. If the dose of tin be too small, which is the fault most easily remedied, the composition will be yellowish; if it be too great, the composition will be of a grey colour, and dull appearance. He casts the speculum in sand with the face; takes its out while red hot, and places in hot wood-ashes to cool, without which precaution it would break in cooling. Mr. Little recommends the following proportions:—32 parts of the best bar copper, 4 of brass pin wire, 16½ of tin, and 1¼ of arsenic. Silver he rejects, as it has an extraordinary effect of softening the metal; and he found that the compound was not susceptible of the highest polish unless it was extremely brittle. He first melts the brass and adds to it about an equal weight of tin: when this mixture is cold he puts it into the copper. Previously fused with black flux, adds the remainder of the tin, and lastly the arsenic; this mixture he graduates by pouring it into cold water, as Mr. Edwards did, and fuses it a second time for casting. H. SPAIGHT.

"W. T. Tambrille."—1st. The process of sending persons to sleep is termed animal magnetism; but the faculty in England have no faith in it.—2nd. A common-sized man consumes about 46,000 cubic inches of oxygen per day, and makes about twenty respirations in a minute; but these circumstances vary in different individuals.—3rd. The nearest fixed star to us is the dog-star, or Sirius. Mathematicians have computed his distance from us to be two billions and two hundred thousand millions of miles. The motion of light, therefore, which, though so quick as to be commonly thought instantaneous, takes up more time in travelling from the stars to us than we do in making a West India voyage. A sound would not arrive to us from thence in 50,000 years; which next to light, is considered as the quickest body we are acquainted with. And a cannon-ball flying at the rate of 480 miles an hour, would not reach us in 700,000 years.

SIR,—As "Q. E. D." has not answered "J. S. H.'s" query in Number 56, I will endeavour to do it: but he has not said which pulley is to correspond with the 24 in. groove; if the 3 in., then a 22½ in. groove will be required for the 4½ in.; and a 21 in. groove for the 6 in. pulley. He will see by this, that in proportion as the diameters of the pulleys are increased, so the diameter of the corresponding wheel must be decreased. The distance of centres is immaterial.
J. T. G.

P.S.—I should wish to remind your scientific Correspondents that we are not all versed in algebra who read the "Penny Mechanic." I should like to see a few common figures used.

"A Constant Reader" can purchase flexible pipe at Warne's, Jewin Cresent.

*How to transfer Figures on Glass.*—Draw on paper the subject you desire to paint. Lay it on a table or any flat surface, and place the glass over it: then draw the outlines, with a very fine pencil, in varnish mixed with black paint, and when dry, fill up the other parts with their proper colours. Transparent colours must be used for this purpose, such as carmine, lake, prussian blue, verdigris, sulphate of iron, tincture of brazil wood, gambouge, &c.; and these must be tempered with a strong white varnish, to prevent their peeling off, then shade them with black, or with bistre, mixed with the same varnish.
J. E. GODDARD.

## TO CORRESPONDENTS.

*Correspondents are informed, that Poetry is never introduced within the pages of* The Penny Mechanic.

*If* Mr. Matthews *will send us the paper and drawing of his Safeguard for Steam Carriages, it shall be noticed; but we cannot promise a very early insertion, as we have several sketches by us at present, which we have promised to publish.*

Received, Sigma—N.—An Engraver—G. H.—Well-wisher, &c., &c.

* A lever-wheel is a wheel when used as a lever, the power of that lever being—in proportion—according to the radius of the wheel.

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand and may be had of all Booksellers.

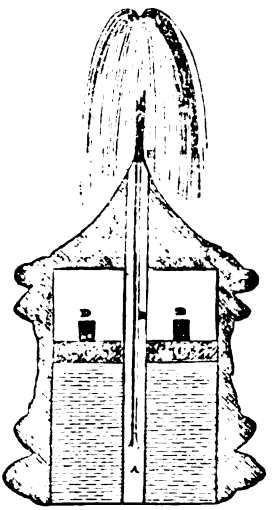
Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LXIX.] SATURDAY, FEBRUARY 17, 1838. [Vol. II.

### GARDEN-FOUNTAIN.

FIG. I.



### ELECTRICAL-MACHINE.

FIG. II.

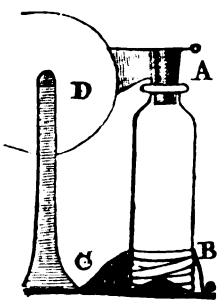
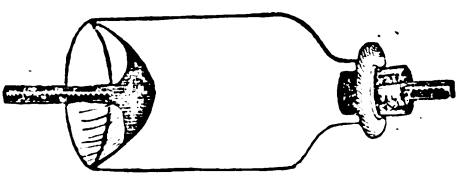



FIG. III.





Holloway Press: D. A. Doudney.

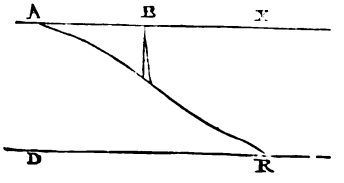
Digitized by Google

## ON LEVELLING.

NO. IV.

PROPOSITION IV.

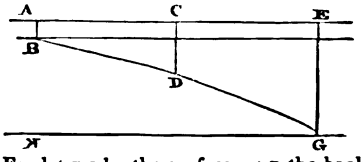
The standard or base line is always in the plane of the horizon.




For let A B be the surface, and A the starting point, and suppose the instrument at B perfectly adjusted, then will the visual ray, A X, cutting the staff, be in the horizontal plane, and A X, indefinitely produced, is the standard base line; therefore the standard base line must be in the plane of the horizon. The use of this proposition will be seen in a subsequent article.

PROPOSITION V.

The difference of level of any two places taken by the spirit level, is as the difference of the fore and back sights.

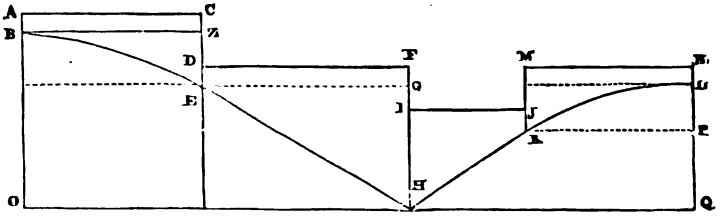



For let B C be the surface; A B the back sight; C D the place of level: then is F G the true difference required; for A B — E G = F G, because of the parallels A E & B F or {back sight} — {fore sight} = true difference of level required.

This proposition might have been deduced directly from (prop. 1); but as distinction is my aim, I thought it would be best to give them separate; the difference of the two methods is obvious at a glance. The next proposition will contain a general rule involving all the preceding cases, which is the common practical rule by which all levelling observations are reduced, &c.

PROPOSITION VI.

Being the general extension of the preceding propositions.




Let B be the commencing point, E H K L any intermediate points, L being the terminating point:

Then B A — C E = Z E
D E — F H = G H } both being falls;

∴ Z E + G H = B O = reduced level to point H being falls.

And I H — J K = P Q
M K — N L = L P } both rising.

∴ P Q + L P = L Q = reduced level.

Now at the point H, the difference of curvature commences, and thence obviously the true difference of level of B and L, is equal to the difference of level of B O and L Q.

= B O — L Q = difference.

{Z E + G H} — {P Q + L P} = difference.

{ {B A + D E} — {C E + F H} } — { {I H + M K} — {J K + N L} } = difference.

= { (B A + D E) + (I H + M K) } — { (C E + F H) + (J K + N L) } = difference.

= { (Sum of back sights) } — { (sum of fore sights) } = true difference.

Which is the general practical rule geometrically deduced, and which expresses both geometrically and verbally the rule; this is mostly used in practice.

Digitized by Google

The above is a complete solution of the question, viz. that of finding a general rule for reducing the levels from the field-book previous to laying down any section in plan; it is obvious how the proof is obtained. I have first given expressions for each of the falls or rise as the case is, and then their difference, which is finally expressed as B O — L Q = difference, in which the values of B O and L Q from the first expressions are substituted; and then by transposing all these with the same signs, to the same side, we get two quantities involving the sum of all the fore sights, and the sum of all the back sights, which, by taking their difference, gives the true difference, according to (prop. 6.) The dots in topmost lines is the supposed places of the levelling instrument; and in this case, for the sake of simplicity only, the surface is supposed to touch the base line at the point H; but it is plain that it is just the same whether it happen to be above or below the line, the process being evidently the same. In the preceding tracks I have not noticed the rule for simultaneous levels, which is simply the following. Subtract the successive sights from each other continually, and the sum of their differences will be the true reduced level required: this rule does not require any demonstration on account of its simplicity. The whole of these rules are remarkable for their simplicity, and the ease with which they may be verified and demonstrated; they are, as I hope, deduced from pure logical principles; and as this mode of treating the subject is new to myself, and most of your readers, I hope it may not prove either uninteresting or useless. This paper concludes the demonstration of the rules; my next will show, by examples, the method of applying them.

Jan. 14, 1838. TYRO LOCK.

## COMBUSTION.

THE following question is asked by "A. R. Y. Z." in No. 58. "*It is well known that a poker, when placed across the fire, creates a more rapid combustion of the fuel; how is this effect produced?*"

Much unprofitable discussion would be avoided, if we were always careful to ascertain the reality of a fact before we speculate upon its cause. So many erroneous notions are said to be "undeniably true," "known to every body," &c., that little, or no reliance can probably be placed upon testimony of this nature. The coincidence of two events, however dissimilar they may be in their nature and tendency, often leads to the erroneous inference that one is dependant upon the other; thus a sick person fancies he is cured by taking a nostrum, when in reality, he is cured by the action of nature, not *with the aid of*, but *notwithstanding* the nostrum; so I believe it to be when a poker is placed across the fire: the poker does not make the fire burn, but it burns in spite of the poker. I have tried the experiment several times, and could never perceive that the poker affected the progress of combustion in any degree. The idea of a cold bar of iron imparting to the coals an aptness for combustion, cannot, I think, be entertained; neither can it promote the current of air through the fire, so long as it remains colder than the surrounding air; but will, on the contrary, retard the ascending column, by absorbing its heat, and consequently condensing it. I have asked several persons, who practice this manœuvre, why they do it? hoping that their answer might be founded upon some traditionary theory, but in this too I failed; one says it "divides the draught," another that it "attracts the heat," another that it "draws the moisture from the coals," and it is my painful duty to say, that another, (a lady) does it "because it vexes her husband:" neither of these reasons have any intelligible meaning; finding therefore that pokerology is unsupported by reason and experiment, and even its professors adduce no argument in its favour, I dismiss it as a fallacious science, and consign it to the suburbs of my mind, there to dwell with astrology, homœpathy, phrenology, witch and other crafts, soothsaying seriousness,* necromancy, tee-totalism, and animal magnetism. Q. E. D.

## STEAM-ENGINE CRANKS.

THE very strange remarks which have recently appeared in the Penny Mechanic, on the action of the crank in steam-engines, induce me to lay before the readers of this work, a brief outline of the chief properties of that important member of the most valuable of all machines.

1st. The whole force of the steam expended in raising the piston, is effective in the production of rotatory motion in the crank.

2nd. Every equal portion of the piston's ascent, produces equal effect in propelling the machine.

* "Seriousness" is a technical term employed to designate that vice which the uninitiated call *hypocricy*. With this definition, (and I use it here in no other sense,) I shall not, I trust, be blamed for discarding it.

Digitized by Google

3rd. The effective pressure is to the whole pressure of the piston, as the radius of the circle described by the crank to the sine of the angle of the crank, from the perpendicular, (the connecting rod is here supposed to move parallel to itself; the effect of its angular motion is referred to a separate correction for the purpose of simplifying this proposition).

4th. The relative velocity of the piston is as the sine of the angle of the crank, and also proportional to the effective force impressed upon the crank.

5th. The mean effective force on the machine during the piston's ascent, is to the maximum (90°, when sin. = rad.) as twice diameter to circumference, or 7 to 11 nearly.

6th. If two pistons act upon cranks placed at right angles with each other, on the same axis, the maximum of their combined forces is when they are at equal distances from the perpendicular, or direction of pressure, and the minimum when one is at zero, and the other at 90°; 2 sin. 45° being greater than rad., and any deviation from that point will lesson the sine of one angle, more than it inereases the sine of the other.

My present object is not to expatiate upon this subject, nor to exhibit all the data upon which calculations may be founded; I merely wish, if possible, to avert an impending controversy, by recommending to the consideration of the parties alluded to, these propositions as their observations have suggested. They certainly appear to me, too manifestly true to require demonstration; but should a wish to that effect be expressed, I will with pleasure explain them more fully. I am aware of the prevalence of a notion that power is lost in the action of the crank: but let it be observed, that when the crank is at zero, no steam is expended, and in every other position, so much steam only is expended, as is effective in the production of motion. The effect is exactly the same as if the piston were to act successively upon all the parts of a straight lever extending from the centre to the circumference of the circle described by the crank. The force is unequally distributed, but not diminished.

It must be observed that the foregoing applies only to the essential properties of the crank, supposing the pressure on the piston to be continued uniform, without consideration of the various effects which which may be produced by friction on any peculiar construction of the machine.

It must be observed that the foregoing applies only to the essential properties of the crank, supposing the pressure on the piston to be continued uniform, without consideration of the various effects which may be produced by friction, or any peculiar construction of the machine.

Q. E. D.

## NEW METHOD OF WARMING ROOMS, &c.

THE discovery noticed in our No. 63, of a new method of generating heat in a small confined vessel, sufficient to warm a room of considerable size, is exciting a good deal of attention at the present time. The discovery appears to have been the result of accident, rather than of experiments made for the purpose. The properties of the combustible employed were first noticed by a gardener, but being a poor man he had no means of securing to himself the benefits of the discovery. A gentleman of considerable influence in the city, becoming acquainted with the circumstances, very generously came forward and assisted him, and patents are now being taken out for Great Britain, France, &c. There can be no doubt, if the piece of apparatus is capable of producing the effects attributed to it, that the invention is one of the most important that has been made for some years. There is probably no country in which dwelling-houses are so imperfectly, although so expensively warmed, as in England; and the advantages of possessing an elegant piece of apparatus, by which a comfortable degree of heat may be maintained, and that too at the least possible expense, are too obvious, therefore, to require a detailed notice. The nature of the combustible employed at present remains a secret, although many ingenious suggestions have been made to account for its peculiarities. One is, that the gardener who discovered the fuel which enabled him to keep up a fire whilst he slept, must have used old tanners' bark, as that was the only fuel accessible in a hot-house. Others suppose that charcoal is the base; and that lime is employed to absorb the carbonic acid. It is said that Gipsies are in the habit of using the ashes of their fires, raked together in a heap, and sprinkled with lime; this will burn throughout the night and give out much heat, and no deteriorating gas is evolved to distress the sleepers. This application of lime might be found eminently useful in factories, &c., where charcoal is burnt, to prevent the carbonic gas that is generated from producing any deleterious effects on the persons at work. It is well known that

Digitized by Google

when water is poured on lime very considerable heat is given out, and some persons have asserted that this is the secret of the invention. It is questionable, however, whether any great degree of heat could be maintained for any length of time by this method; and this the instrument is capable of producing. Whatever may be the nature of the combustible, it is capable of producing a very agreeable degree of heat for a considerable length of time: it is said that it is only necessary to replenish the stove in which it is burned once in thirty hours. The prices of them will vary from two guineas to one hundred; but it is said that the saving in fuel will soon repay the outlay.

## ELECTRICAL TELEGRAPH.

*To the Editor of the Penny Mechanic.*

I HAVE been much pleased with the electrical telegraph of your modest but talented correspondent L., and must certainly give it my most hearty recommendation to the notice of the public—and for what reason—that for which many other people might reject it for—its extreme simplicity. All other machines that I have seen are much too complex ever to be brought to actual practice, but to this of L.'s no objection can be reasonably made on this score in any way, either on the whole or in detail, for it is very plain that there is nothing complex about it; some may object to the wires passing under ground as likely to be torn up spitefully—stuff!—why are not the gas or water pipes torn up for "spiteful sport?" Or they may object to there not being a sufficient quantity of electricity to be had, when required to discharge the letters of a long communication; to this I answer, firstly, long communications are never required or sent by telegraphic dispatches; and secondly, if they do happen to be long, a good galvanic battery will always keep accumulating a sufficient quantity, which can be collected in the usual way: and thirdly, they must not suppose that the machine is to be always working, like a Cornish steam-engine, and therefore a constant quantity of electricity will not always be required; therefore, there will be plenty of time to collect electricity to any extent. Had this machine been brought out by an F.R.S., C.E.F.S.A., &c., it would have made as much noise, and attracted as much attention, as any of them; and I would advise L. to persevere, and keep a sharp look-out for smugglers, for some people think that F.R.S. attached to their name gives them an undoubted right to pirate the beauties of a machine invented by an unfortunate "unknown," and force them on the world as their invention; this has been, and is done in the present day; and a poor, but open-hearted inventor, who has no desire to mystify the public, cannot be too quick in looking after his own rights, as some of these F.R.S.'s are not so exactly correct as they should be.

I am, &c.

TYRO LOCK.

## ANSWERS TO THE QUESTIONS IN No. 52.

QUESTION V.

*Can a Man see his own Face?*

YES; and its antipodes too, if he looks in the glass. This, though the accurate answer, is the one we should expect from an uninformed person; if the same question could be proposed to a vestry meeting, they would probably declare almost unanimously, that a man does not see his own face, but its reflection, or image, &c.; this is *ratiocinatio verbosa*, or reasoning upon words instead of things; a very great, though very common fault with too many reasoners. Sight is a sensation caused by the action of light, which proceeds from luminous bodies, and passing through the refracting media of the eye, forms an image of the object we contemplate, upon a surface endowed with that sensibility which enables us, with the aid of constant experience, to distinguish the shape, colour, and to some extent, the size, distance, and direction of the object. It is not essential to distinct vision, that the rays should proceed in a right line from the object to the eye; when the sun, or any other celestial body, appears on the horizon, it is really considerably below it; the atmosphere refracting the rays downwards to our eyes. Also when a ray falls upon a polished plane surface, its direction is changed: but *the identical ray emitted from the object is incident upon the eye*, that is to say, *we see the object*, though its apparent place is altered; because we are accustomed to observe the point which emits the light, in a right line with the incident ray.

Q. E. D.

*Grand Junction Railway.*—Heavy goods are now carried on this line of railway, timber excepted. The conveyance has hitherto been confined to passengers.

Digitized by Google

# THE CHEMIST.

## GARDEN FOUNTAIN.

(See Fig. 1. Front Page.)

*To the Editor of the Penny Mechanic.*

Sir,—The following section of a fountain for a garden or other places, consists of a cylinder truly bored containing a large pipe A (which descends nearly to the bottom of the cylinder), withinside of which is a smaller tube B. The action of the water is occasioned by the moveable piston C C, and the weights D D. The water is forced up the large pipe, and then, by the elasticity of the air, it is forced up the smaller one, and to a considerable height.—The horifice at E should be very small.

I remain Yours, &c.

J. Hilton.

## ELECTRICAL MACHINE.

(See Figs. II. and III. Front Page.)

*To the Editor of the Penny Mechanic.*

Sir,—Some time back I promised you an account of a simple electrical machine I had constructed; as, however, you have received several communications on the same subject, I shall merely mention one advantage my machine possesses over those of your correspondents; which is, the rubber being supported on glass, we are enabled to obtain the negative spark from it, as well as the positive spark from the conductor, by means of which a number of important experiments may be performed, which could not be without; this is managed simply as follows:—The rubber is glued to a piece of wood, which is inserted in the neck of a small phial, as shown at A, fig. 2, and secured by sealing-wax. A piece of leather is tied tightly near the bottom of the bottle, at back, as at B, the end of which is nailed to the stand to secure it as a hinge; in front of the bottle is tied a piece of India-rubber, the end of which is also made fast to the stand as at C; so that you see when the rubber is pressing against the cylinder, the elastibity of the India-rubber permits the cushion to yield to the inequalities of the cylinder, and the pressure is always nearly equal. D represents the cylinder: a knob or piece of bent wire must be fixed in the back of the rubber to receive the spark from. If the cylinder is made of green glass, the positive spark is given out by the rubber, and the negative by the conductor; but if of white glass, the contrary. My cylinder is of white glass—a common sample phial, holding about three-quarters of a pint; such a one may be had at any phial shop for 3d. The amalgum for the rubber and flap, may be made of two parts zinc or tin foil, and one part mercury, well mixed. The silvering of a looking-glass is composed of tin and mercury, and answers very well for the purpose. One of the greatest difficulties in constructing a machine as directed by your correspondent F. E. X., is making a hole in the bottom of the bottle which is to serve as a cylinder: this is altogether unnecessary, for if a piece of wood is held carefully in the centre of the concavity at the bottom of the bottle, while melted sealing-wax is dropt in until the stick is well surrounded, as in fig. 3, on the sealing-wax cooling, it will be found quite firm. This is the way it is done in my machine, and although I have used it very much, it has never broken down; the spindle at the other end may be glued in a cork fitting the neck very tightly; be careful to get the spindles opposite each other and in the centre.

I am, Sir,

Your obedient servant.

Bishopsgate St. F. H.

## AMUSING EXPERIMENT.

Half fill a florence flask with water; place it over a lamp, and let it boil for a few minutes; then cork the mouth of the flask as expeditiously as possible, and tie a slip of moist bladder over the cork, to exclude the air. The water being now removed from the lamp, the ebullition will cease; but may be renewed by pouring cold water gradually upon the upper part of the flask; but, if hot water be applied, the boiling instantly ceases. In this manner the ebullition may be renewed and again made to cease, alternately, by the mere application of hot and cold water.

The theory is this:—water boils at 212 degrees, under the common pressure of our atmosphere; now, if the atmosphere, or a part of it were removed, the pressure on the surface would be less, and the consequence would be that water would boil at a much lower temperature; and this leads us to an explanation of what takes place in the foregoing experiment. We fill a flask half full of water, and boil it for a few minutes over a lamp; the steam which rises forces out the atmospheric air, and occupies its place; we then remove the lamp and secure the flask so as to prevent the readmission of atmospheric air. If cold water be poured over that part of the flask occupied by the steam, the cold

Digitized by Google

water will condense it, which will trickle down the sides of the flask, and mix with the liquor below; the steam being thus condensed, a vacuum is formed above the surface. The water then having no pressure of atmospheric air or steam, commences boiling afresh; but if hot water be now poured upon it, the steam again occupies the surface and the boiling ceases.

JEAN E***G.

## INTERESTING EXPERIMENT.

*To the Editor of the Penny Mechanic.*

SIR,—I beg to send you the following very interesting experiment in electricity. Take half a sheet of writing-paper and hold to the fire, and make it as hot as possible; then lay it immediately on another sheet of paper, and rub it briskly with a piece of India-rubber for a few seconds, and it will be very strongly charged with electricity, and will adhere to the sheet of paper on which it is laid, as though it were actually pasted on it, and if drawn off very carefully, strong electrical sparks will be distinctly seen, accompanied with a strong rustling noise; it will very powerfully attract any small particles of light matter, and make them jump and dance *a la quadrille* if the sheets are held directly over each other, and the particles placed between them. If a strong coarse sheet of brown paper be warmed and briskly rubbed with a woollen cloth it will be very powerfully charged, especially if the paper be made very hot by holding it to the fire. Is it not possible to make a machine from this, that shall rank amongst your "cheap electrical apparatus?" Suppose a sheet of good thick paper were coiled round a non-conducting cylinder, and a proper rubber annexed to act upon it in the usual way, and this machine put in motion and excited before a fire, by which means the most electricity would be generated, could the fluid so obtained be carried to a Leyden phial, and changed by the interposition of good conducting substances in the usual way? I think that sufficient electricity might be obtained this way to perform a few amusing experiments, such as are dispersed through the pages of your valuable little work, without the trouble of knocking out the bottom of wine bottles for this purpose, as recommended by many of your talented electricians. As I am not much acquainted with this subject, I leave the experiment to the more experienced of your subscribers. I am, Sir,

TYRO LOCK.

*Metallurgy.*—The experiments of M. Laurent have led him to believe,—1st. That charcoal is not a fixed body, as hitherto supposed, but that it is capable of emitting vapours at high temperatures; 2ndly. That this is also the case with several other bodies hitherto looked upon as fixed,—such as iron, cobalt, nickel, and their oxides; 3rdly. That the passage of different solid bodies into other solid bodies is not effected by molecules under the influence of an electric current, but by one of them passing in the form of vapour into the pores of the other. M. Laurent imagines that these observations may be usefully applied to metallurgy.—*Athenæum.*

*To Extract and Preserve the Red Colour of Cabbage.*—Digest the leaves of the cabbage in warm alcohol, and when the whole of the colouring matter is extracted, distil off a portion of the spirit, and evaporate the remainder at a very gentle heat to the consistence of a syrup. This extract may be preserved unimpaired for years, if kept in phials closely stopped. To use it, add a small portion of it to water, when the addition of an alkali or acid will produce its peculiar effect. To employ this test to detect small quantities of carbonic acid, add to it a little diluted alkali, which will make it green; and the acid, by neutralizing the alkali, will restore the blue colour. Test papers may be prepared by means of this alcohol tincture of the cabbage, which, when rendered green by immersion in a diluted alkaline solution, may be used in all those cases in which litmus papers are commonly employed.

*Water a bad conductor of Heat.*—Pour a little sulphuric ether on the surface of a glass of cold water, and set fire to it. The ether will burn for a considerable time, producing a large volume of flame; but when it is extinguished the water will be found not to have been at all heated. This shows that water will not convey heat downwards, and that if we want our kettles to boil, heat must be applied at the lower part.

*Destroying Fire-Damp.*—We understand that Mr. Charles Burrows, mason, of St. Austin, after studying many years the best method of destroying damps in coal-mines, which have proved fatal to so many thousands of human beings, has at length succeeded in constructing a machine which will effectually destroy them, and enable the miner to prosecute his work with the aid of a lighted candle, without lantern or any covering, in perfect safety.—*West Briton.*

Digitized by Google

## PLAN FOR STEERING BALLOONS.

SIR,—It appears strange that in this age of invention no plan has yet been found out for the guidance of balloons. I confess that I have not inquired much into the subject, neither do I pretend to understand the management of balloons, or to dictate to those who do; but still one may be able to suggest an idea which might be improved, perhaps, to some advantage.

It appears to me, so far as I have read on the subject, that the plans hitherto proposed, have been by changing the shape and by affixing a helm and flags of some kind. But it should be remembered that there is this difference between the guidance of a ship and a balloon; that with regard to the former, you have two elements to assist you, with respect to the latter, but one. Endeavour to guide a ship deprived of its sails across a wide and rapidly flowing river, and you will, notwithstanding all your skill at the helm, reach the opposite shore much lower down the river; but by means of the wind blowing in a contrary direction, or by some other propelling power, you are enabled to sail against the current. I propose to combine two principles; one taken from nature, the other from art—the wing of the bird, with the paddle of the steam-boat; and thus to propel as well as guide the balloon. Without further preface, I shall endeavour to lay my plan before you.

A is the balloon; B represents a sliding rod made to pass through the balloon, and to shorten or lengthen according as the balloon may be more or less distended; C is a kind of wheel or plate fixed to the sides of the balloon by means of some crossed springs, represented by J, J, J, J, meeting in the centre K; the plate C is also fixed to the sliding rod B, so that it is motionless. The plate C is better represented by fig. 2, the parts L L being raised for the balls at the ends of G and H to work against; D is a wheel working on the end of the sliding rod B, and better represented by fig. 3; E represents one of the sails (of which there may be four, five, or six, as may appear best) open to strike against the air. It is composed of three or four rods connected by means of joints with the cylindrical part of the wheel D, as in fig. 3, and covered with cloth or canvass of any description; F represents the sail partially shut or closed so as to turn round without striking the air; G and H are the instruments for opening and shutting the sails; they are short rods with balls at each end; these balls work upon the raised parts of the plate C, or fig. 2. The rods G and H are fixed to the wheel D by means of raised joints as at M, M: J, J, are strong wires joined to the rods G and H with a joint, and joined also to the several rods which compose the sail by joints, so that in the position G of the small rod, the sails will be open to the air, and in H closed, or lying in a line with the sliding rod B. The wheel D is to be turned round by means of a band or line passed round it and round another wheel in the car. The necessity for closing the sails while they take a part of their round, is, that they would otherwise beat all ways or in all directions at the same time, and therefore would have no effect. There must be a paddle of the kind above described on each side of the balloon, made either to be worked both together, or one at a time, as the case may require.

I am, your's truly,

A FRIEND TO IMPROVEMENTS.

## PREVENTION OF ACCIDENTS TO SKAITERS.

So many schemes have been devised to preserve skaiters from accidents and suicide, and so little benefit has been derived from them, that the announcement of another invention for that purpose, is likely to create about as much interest as a new stamp for gingerbread, or a new pattern for parachutes. Frail indeed is the hope of success, when we contend against the follies of mankind; but no consideration will justify the relaxation of our utmost efforts, when the evil we have to combat, is in its consequences so afflicting, and so desolating as this perverse and deplorable passion, which must be gratified even in the jaws of death. How many bright eyes, beaming with pleasure, and the etherial joy of unclouded hope, have been plunged into the gloom of hopeless grief, by one fatal crash, turning the gay waters of our parks into a cruel and untimely grave; how many scenes of buoyant hilarity and thoughtless mirth have given place to funeral moans, and the shrieks of despair?—and all this desolation is to be suffered, because certain gentlemen think it necessary to slide about in pattens, and respectable females deem it consistent with propriety to mimick such anticks. All these evils might be avoided without inconvenience to any rational being; and it is extremely wrong that such a state of things should be tolerated.

Digitized by Google

# THE PENNY MECHANIC,

## AND THE CHEMIST.

Nos. LXX. & LXXI.] SATURDAY, FEB. 24, 1838. [*Price 2d.*

### PLAN FOR GUIDING BALLOONS.

FIG. I.

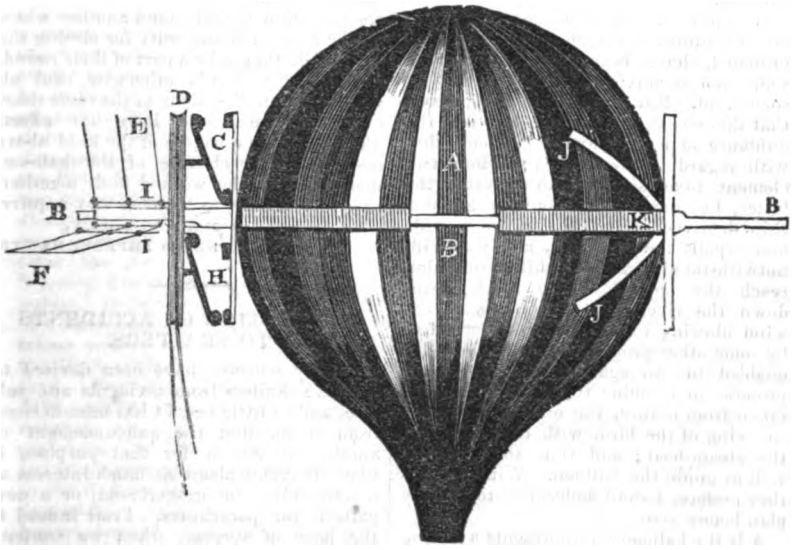



FIG. II.

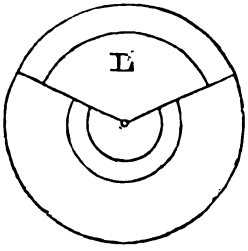
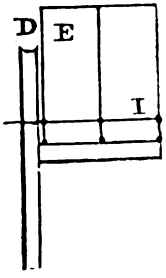



FIG. III.






Holloway Press: D. A. Doudney.

Digitized by Google

## PLAN FOR STEERING BALLOONS.

SIR,—It appears strange that in this age of invention no plan has yet been found out for the guidance of balloons. I confess that I have not inquired much into the subject, neither do I pretend to understand the management of balloons, or to dictate to those who do; but still one may be able to suggest an idea which might be improved, perhaps, to some advantage.

It appears to me, so far as I have read on the subject, that the plans hitherto proposed, have been by changing the shape and by affixing a helm and flags of some kind. But it should be remembered that there is this difference between the guidance of a ship and a balloon; that with regard to the former, you have two elements to assist you, with respect to the latter, but one. Endeavour to guide a ship deprived of its sails across a wide and rapidly flowing river, and you will, notwithstanding all your skill at the helm, reach the opposite shore much lower down the river; but by means of the wind blowing in a contrary direction, or by some other propelling power, you are enabled to sail against the current. I propose to combine two principles; one taken from nature, the other from art—the wing of the bird, with the paddle of the steam-boat; and thus to propel as well as guide the balloon. Without further preface, I shall endeavour to lay my plan before you.

A is the balloon; B represents a sliding rod made to pass through the balloon, and to shorten or lengthen according as the balloon may be more or less distended; C is a kind of wheel or plate fixed to the sides of the balloon by means of some crossed springs, represented by J, J, J, J, meeting in the centre K; the plate C is also fixed to the sliding rod B, so that it is motionless. The plate C is better represented by fig. 2, the parts L L being raised for the balls at the ends of G and H to work against; D is a wheel working on the end of the sliding rod B, and better represented by fig. 3; E represents one of the sails (of which there may be four, five, or six, as may appear best) open to strike against the air. It is composed of three or four rods connected by means of joints with the cylindrical part of the wheel D, as in fig. 3, and covered with cloth or canvass of any description; F represents the sail partially shut or closed so as to turn round without striking the air; G and H are the instruments for opening and shutting the sails; they are short rods with balls at each end; these balls work upon the raised parts of the plate C, or fig. 2. The rods G and H are fixed to the wheel D by means of raised joints as at M, M: J, J, are strong wires joined to the rods G and H with a joint, and joined also to the several rods which compose the sail by joints, so that in the position G of the small rod, the sails will be open to the air, and in H closed, or lying in a line with the sliding rod B. The wheel D is to be turned round by means of a band or line passed round it and round another wheel in the car. The necessity for closing the sails while they take a part of their round, is, that they would otherwise beat all ways or in all directions at the same time, and therefore would have no effect. There must be a paddle of the kind above described on each side of the balloon, made either to be worked both together, or one at a time, as the case may require.

I am, your's truly,
A FRIEND TO IMPROVEMENTS.

## PREVENTION OF ACCIDENTS TO SKAITERS.

So many schemes have been devised to preserve skaiters from accidents and suicide, and so little benefit has been derived from them, that the announcement of another invention for that purpose, is likely to create about as much interest as a new stamp for gingerbread, or a new pattern for parachutes. Frail indeed is the hope of success, when we contend against the follies of mankind; but no consideration will justify the relaxation of our utmost efforts, when the evil we have to combat, is in its consequences so afflicting, and so desolating as this perverse and deplorable passion, which must be gratified even in the jaws of death. How many bright eyes, beaming with pleasure, and the etherial joy of unclouded hope, have been plunged into the gloom of hopeless grief, by one fatal crash, turning the gay waters of our parks into a cruel and untimely grave; how many scenes of buoyant hilarity and thoughtless mirth have given place to funeral moans, and the shricks of despair?—and all this desolation is to be suffered, because certain gentlemen think it necessary to slide about in pattens, and respectable females deem it consistent with propriety to mimick such anticks. All these evils might be avoided without inconvenience to any rational being; and it is extremely wrong that such a state of things should be tolerated.

Digitized by Google

The remedy I propose, is this; let a certain number of fire-engines, according to the extent of the surface to be protected, be placed at convenient distances round the ice infested with skaiters; then, public notice being given, the nearest engine is to play upon the first intruder, and if he or she proceed beyond its rear, another engine may continue the operation, pumping without intermission till the patient abandons the ice. Should the ice be invaded by a large concourse of people, one powerful engine would, with proper management, disperse several thousands; and the water falling upon the ice, would render the surface so uneven that it would be unfit for skaiting. This plan was adopted in 1832 by M. Lobau, to quell the riots which were so frequent in Paris at that period. It was first introduced in the Place Vendôme, where a great crowd was collected for the purpose of making a disturbance; although many thousands were assembled, one engine sufficed to clear the place in a very short time; "young France," caught cold, "the republic" sneezed, and the mob dispersed. We have also the testimony of an illustrious prince, His late Royal Highness the Duke of Kent, in favour of this method. Previous to the great eruption of 1793, which covered half Europe with demons, and all England with tax-gatherers, the little territory of Geneva, (which is now united in second marriage to the Helvetic Confederation), was an independant, virtuous, and consequently happy, though somewhat turbulent republic. During the residence of Prince Edward in this microscopic state, frequent broils occurred between the "magnificent lords" (such was the title of the councillors of state) and "the people" who inhabited the lower part of the town. Upon one occasion the demands of the people were of such a nature, that the magistrates resolved to show fight rather than accede to them; an army, fifty strong, was accordingly sent to reduce the rebellious Saint Gervais to obedience; but the will of a nation is mightier than the wrath of a ruler; the bridge was barricaded, and every preparation made for a determined resistence. Under these circumstances, the fire-engines of Saint Gervais were first brought into requisition as instruments of war; hot soap-suds was prepared by patriotic dames, and supplied in buckets to the engines; the soldiers, half blinded by the soap, were soon routed, and the people encouraged by this success, proceeded to the town hall, and compelled the Syndic and his magnificent colleagues to grant the object of their desire. Prince Edward so admired the conduct of the Saint Gervaisans on this memorable day, that he exclaimed, "If I had half a dozen Saint Gervais, I could go round the world;" (je ferais le tour du monde). The "sovereign people" discussed the events of the day over an extra bottle of Beaujolais; the Synetic read Seneca; and the morning sun lighted a contented and dutiful people to their accustomed occupations. Q. E. D.

## BIOGRAPHICAL SKETCHES.

### Dr. FARADAY.

The subject of the present sketch is perhaps one of the most striking examples of what may be effected by genius and patient industry that the present age affords. The effects of genius in raising, often from the lowest ranks of society, to situations of wealth and influence, those who are so fortunate as to possess the divine gift, might be shown by reference to many individuals of the present day; but it is seldom that obstacles, apparently insurmountable, as those against which Faraday had to contend, have been so successfully overcome. Dr. Faraday was born in 1795, and is therefore now in his forty-third year. His father, who is stated to have been a poor blacksmith, apprenticed him at the age of nine years to a bookbinder, and he continued at that occupation till his twenty-second year. It has been said truly, "there is a tide in the affairs of men, which, taken at the flood, leads on to fortune;" and at this period of his life Faraday appears to have experienced it. He was one day binding some books, when Mr. Magrath, who is now the Secretary to the Athenæum, visited the shop where he was at work and entered into conversation with him. The subject of our sketch, though moving in a humble rank of life, had not neglected the cultivation of his mind, and although not possessing the opportunities for obtaining scientific knowledge, by means of Mechanics' Institutions and cheap scientific works, that every mechanic of our own time can avail himself of, yet he had made himself familiar with more than one of the sciences, and Mr. Magarth was therefore much pleased by his conversation, and surprised to find so much valuable information acquired by a man in his humble situation. But it was in chemistry in particular that Faraday had made the greatest advances; and Mr. Magrath, thinking no doubt that

Digitized by Google

talents like his should receive every encouragement, presented him with a ticket for a course of lectures, by Sir Humphrey Davy, at the Royal Institution. This was a great era in the life of Faraday; it gave a fresh stimulus to his exertions, and opened to him the means of acquiring a vast fund of information, which previously his poverty had entirely prevented him availing himself of. The lectures afforded him the greatest pleasure, and daily, it is said, might the nondescript be seen perched, pen in hand, and "his eyes starting out of his head, just over the clock, opposite the chair." When the course was finished, Faraday, as the only means of saving himself from the life of obscurity to which his humble circumstances necessarily devoted him, determined to write to Sir Humphrey Davy, stating the full particulars of his birth, the manner in which he had passed his early years, and soliciting Davy's assistance to enable him to pursue those studies for which he felt the most passionate ardour, and to which he determined, if possible, to devote himself. Davy, whose benevolence was not excelled by his high scientific acquirements, immediately made himself better acquainted with his history, and appointed him an assistant in his laboratory. After a few years, becoming more convinced of the value of his humble friend, he made him his secretary. It has been said that the greatest discovery Davy ever made, was the discovery of Faraday; and certainly Sir Humphrey appears to have been sensible that his talents were of no mean description, since on every occasion he advanced his interest as much as possible, and let no opportunity pass that could in any way contribute to his professional eminence.

He took Faraday with him to the Continent, and introduced him to many of the most celebrated men of the time; and the brilliant success of his pupil must have been an ample reward to a man of the generous disposition of Davy for all the acts of kindness he performed.

The discoveries of Faraday in the science of electricity, have probably tended more to establish his fame than his acquirements of a different description, although we believe there are few persons better versed in science generally than himself. We trust that he will long continue to enjoy the honours that have lately been conferred on him, and assist as generously in forwarding the exertions of humble men, as his own were by his deeply-lamented friend and patron, Sir Humphrey Davy.

## DR. ARNOTT'S THERMOMETER STOVE.

THE attention of scientific men has frequently been drawn to the very defective means employed in this country for warming buildings. The obvious disadvantages of the stoves in common use have led to the construction of a variety of an improved description; but from some cause or other, none of them have been generally adopted. Count Rumford, some years ago, expended considerable sums of money, and devoted much valuable time, to produce stoves better adapted for the purposes for which they are required than those now used. His improvements have been more frequently adopted than others, but it is impossible, even in these stoves, to effect the complete combustion of the coal, a radical improvement was required. To give some idea of the waste of fuel in common stoves, we may state, on the authority of Dr. Arnott, that of the whole heat produced from the coals used, about seven-eighths ascend the chimney, and are absolutely wasted. The loss of heat is, first, the more than half, which is in the smoke, as it issues from the burning mass; secondly, that carried off by the current of the warmed air of the room, which is constantly entering the chimney between the fire and the mantel-piece, and mixing with the smoke:—this is estimated at nearly two-eighths; thirdly, it is a fact, that the black, or visible part of the smoke of a common fire, is really a part of the coal or wood escaping unburned. If, then, more than half of the heat produced be in the smoke, and nearly a fourth of it in the warm air from the room which escapes with the smoke, and if about an eighth of the combustible pass away unburned, there is a loss of at least seven-eighths of the whole. Count Rumford estimated the loss at still more, namely, fourteen-fifteenths.

The only plan of remedying this evil appears to be, burning the fuel in a stove that is not open to the atmosphere; and this is the principle of the German stove, to a certain extent. Dr. Arnott has brought stoves of this description to the highest degree of perfection; and his thermometer stove, which we are about to describe, being constructed on philosophical principles, is probably better calculated to effect the complete combustion of the fuel than any that has ever been invented. His improvements, like most other great improvements, have been progressive. He first directed his attention to the methods of warming dwellings by means of hot-water pipes; and whatever disadvantages

Digitized by Google

may attend this method, it is probably the best that has yet been adopted. It occurred to him, however, that it might be improved upon, and the expense attending this plan much lessened, if, instead of having a quantity of pipes containing hot water supplied from a distant boiler, a vessel of water, having a fire within itself, were placed in each apartment. This constitutes what is termed the water-clad stove, and a consideration of the principle on which it operates eventually to the invention of the thermometer stove. "The object sought," says Dr. Arnott, "was now clearly seen to be, merely to place in any apartment the required extent of metallic surface kept steadily at a temperature not exceeding 260° of Fahrenheit. It evidently was of no importance what hot fluid filled and warmed the vessel, whether water, steam, oil, or air, or whether there were an included fire, provided that the temperature of the surface was maintained; for the box in any case would be quite close, permitting no escape of its contents. If, therefore, in a box of the required size, a fire could be placed so as to warm the box with perfect uniformity all around, while the fire itself was so controlled by a self-acting regulator, that it should burn always as fast as was required to keep the box steadily at any desired temperature, the object sought would be obtained, and there would be many concomitant advantages of cheapness, simplicity, &c." These words have sketched the thermometer stove, or self-regulating fire, of Dr. Arnott. It is simply a box of iron containing a fire; only as much air is admitted by a valved opening in the ash pit as will just feed the combustion, and only a small corresponding quantity of air can pass away by the chimney; the whole box, therefore, soon becomes full of hot air or smoke from the fire circulating in it, and rendering it everywhere of as uniform a temperature as if it were full of hot water. It is found that the best temperature is about 209°; if higher, the air in contact with the sides of the stove is decomposed, and becomes unhealthy. The inventor states, that during the winter of 1826-7, his library was kept at a uniform temperature, between 60° and 70°, at an expense of one penny per day, which was little more than the cost of the wood used to light an ordinary fire. This stove can be manufactured cheaply, and in any form. The inventor says, "Many persons coming into my room did not suspect I had a fire in the stove, for it was used generally as a table for a bookstand. It is a good cooking stove, and is, therefore, the poor man's stove."

We trust, as the advantages of this stove becomes better known, it will be generally adopted; consequences of no ordinary importance would follow. There would be an immense saving of coals, and they would consequently become cheaper. The atmosphere of London, as these stoves consume their own smoke, or rather generate none, would become much purer, and the health of the inhabitants of this metropolis would consequently be improved; and, lastly, though perhaps foremost in importance, the poor would be enabled to enjoy comforts at home—warmth and the convenience for cooking—both of which in the present day they deplorably stand in need of. We may probably have some further remarks to make respecting this invention at some future time; we consider it one of national importance, and recommend it to the serious consideration of our readers.

Dr. Arnott, in his work just published on Warming and Ventilating, says, "In London, within a few weeks, a new stove has been exciting curiosity, although its nature has not been disclosed; and I am induced to notice it, because many persons have been confounding it with the thermometer stove, invented by myself. In the body of this work is described a modification of the thermometer stove, adapted to warm carriages, &c., or to be immersed in a bath to warm it; which modification may be of any size, from that of a quart jug upwards, standing on a support, or suspended like a lamp, with a small tube to carry away the smoke or gases of the combustion, and which will maintain, like the other forms of the stove, an unvarying temperature of twenty-four hours or more, without being watched or touched, at an expense of a penny or twopence, according to the size. The new stove alluded to, I have heard described in nearly the same terms. It is not said of it, however, that the heat is uniform; and the expense of fuel, even for a small one, has been estimated at a farthing an hour, which is much more than for a large thermometer stove. Then it is stated of it, that a stove of three or four feet surface is sufficient to warm an ordinary room, such as we know to require sixteen or twenty feet surface of an ordinary iron pipe, or other vessel containing boiling water; now this can be true only if the temperature of the smaller vessel be proportionably higher; and we know that a temperature in it but a little higher than that of boiling water, would

Digitized by Google

render its presence in a sitting-room insufferable, from its injuring the air which touched it. Then it is to be used without a chimney; but evidently if there be combustion in it of any kind, the aerial products of combustion, always noxious to animal life, must spread in the room; and, lastly, if there be no combustion in it, but merely a heating by ordinary chemical action, as when water is dropped in quicklime, there will be comparatively little heat, and the apparatus will not be applicable to many of the purposes of a fire. But to decide aright respecting it, we must know what it is." J. S. D.

## SOCIETY FOR PROMOTING PRACTICAL DESIGN.

THE following is an account of the inaugural meeting, of the Society for Promoting Practical Design, and Diffusing a Knowledge and Love of the Arts among the People, held at Exeter Hall, January 11th.

MR. ELMES, in addressing the Meeting, said, I shall briefly point out to you the outline of the objects of the Society to spread a knowledge of the Arts among the people, and to show the various modes of applying them to the different branches of trade and manufactures. These objects of the Society will be carried into effect by the following courses:—General —1. Geometry and Drawing. 2. Modelling. 3. Light, Shade, and Colour. Secondary—1. Human Figure and Anatomy. 2. Zoology. 3. Botany. 4. Ornament and Heraldry. 5. Architecture. 6. Machinery. — Technical—in which these courses of instruction will be specially applied to the respective trades. Instruction will be imparted by means of evening classes, to be followed by lectures. A museum of casts and models of all kinds, and a library of the best foreign and English books and engravings, applicable to the pursuits of the pupils, are in progress. It is also proposed to open a Day School for females (many of whose pursuits are intimately connected with the Arts), under the superintendence of competent female teachers, who have already offered their assistance.

I shall allude to the advantages which a knowledge of the Arts, systematically and scientifically acquired confer upon the manufactures of the country. I may cite the value which has been attached to the Portland vase, which, although in fact at one time considered inestimable, it had been merely for the purpose of giving a name to it: the value had been set down at £10,000. It had been lent to the Trustees of the British Museum. It was not admired for the material of which it was composed, but for the exquisiteness of the work with which it was ornamented. Mr. Wedgwood had been the first who attempted to imitate this gem of porcelain, and he could afford to furnish them at thirty guineas each; and, I believe, that Mr. Purdon has so far improved in the art as to enable him to furnish them at a lower rate. I regret that Drawing and the cultivation of the Fine Arts have been so much neglected in this country, seeing the advantages they have diffused in foreign parts, where drawing was as cheap as writing. (*Cheers.*)

Mr. Hyde Clark said, in the Drawing Classes, as in all others, no deficiency will be allowed of any branch of knowledge necessary to correct instruction; this Class will, in its 1st and 2nd sections, teach Free Drawing, with Elementary Geometry and Stereography; in the 3rd and 4th section, the Elements of Optics, Perspective, and Isometrical Perspective.

In the Colouring Class will be taught Optics and Perspective, with the Theory of Light, Shade, and Colour, and the Chemistry of Colours. I regret that, in this country, so deficient is the knowledge on this subject, that we imagine the effect of colours to be produced only by chance, instead of being subjected to laws as settled and immutable as those of Geometry and Arithmetic. It is to this knowledge that the French owe their superiority, while we pay to foreign manufacturers the price and penalty of our own ignorance.

In the Machinery Class will be taught the Elements of Machines: and this class we esteem as most important, for machinery; as it has already created the commercial wealth, I hope it will foster the artistical genius and taste of the nation. (*Cheers.*)

Of the necessity of Drawing to the working classes, we are convinced by our experience and by what we have heard this night; it is to them a branch of education as essential as reading, writing, and arithmetic. (*Hear.*) Many a carpenter can draw his plan who can neither read nor write: and when, as I trust, the Museums and treasures of Art and Science in this country are opened to them as a relaxation from their physical toil, I am convinced that they will feel its value to them, as a means of carrying to their own homes notes and representations of what they have seen.

Mr. Anthony Morton, a Member of the

Digitized by Google

Committee and one of the Working Classes, rose and said,

Mr. Chairman and Gentlemen; I address this meeting as one of that class,

> Who toil at e'en, and toil at morn,
> Whose work is never thro';
> With a coming life of weary toil
> For ever in my view.

It is stated in the Prospectus before you, that the object of this Society is to spread a knowledge and love of the Arts among the People, and to show the various modes of applying them to the different branches of trade and manufactures; and our honourable friend, Mr. Wyse, has asserted, that the People are determined to apply the Arts to their own use. I am prepared, Gentlemen, to show from personal experience, that a portion of the working-classes with whom I am connected are determined to carry out that intention; *(cheers)* and to explain to those of my hearers, whose existence, like my own, is maintained by the application of their physical powers, that, if they will make the attempt with a steady and determined perseverance, they will find themselves able to conquer difficulties, which in the outset may appear insuperable. *(Cheers.)*

It is upwards of three years since, that two working carpenters reflected, that the working-classes, by joining themselves into small societies, would be able to establish libraries and reading-rooms for their own use, with schools for the instruction of their children; the idea thus formed, to work they went—extending those views to others of their fellow-workmen; and in November, 1834, a preliminary meeting was held, at which it was resolved to establish a society for such purposes, and a committee was appointed to draw up rules for the management thereof. In December, the society was established with thirty-six members, many of whom subscribe solely for the benefit of sending their sons to the classes. A small entrance-fee was proposed, with a proviso that the members might present a book or books in lieu thereof—thus we laid the foundation for a library, which now consists of nearly two hundred volumes. On the 1st of January, 1835, the first lecture was delivered. At the commencement of our society we were compelled to hold our meetings in a public house, but in February we resolved to take private premises for the use of the society. In March we established a subscription library for periodicals: in July, evening classes for Writing, Arithmetic, and Short-hand were established; and in October, classes for Practical Geometry, Drawing, and Architecture. To encourage habits of economy, and extend the social advantages, it was resolved that a benefit society should be added, which, holding its meetings in a private house, would offer advantages to its members above any benefit society that is at present, or may hereafter, be held at a public house: thus equally promoting habits of industry, application, and temperance. *(Cheers.)* On the 15th of October, 1835, "The Benevolent Society of Carpenters and Joiners" was established, with eleven members of our Literary Institution, being members of various other benefit societies. From this small beginning we have been successful beyond our expectations; our present number of members being fifty-seven, and gradually increasing. During the last twelve months our members received benefits during sickness and accidents to the amount of nearly forty pounds. Thus, Gentlemen, by a system of mutual instruction and assistance, have we succeeded in benefiting and promoting the great causes of education, industry, and temperance. Fellow workmen, go you, and do likewise. *(Cheers.)*

Gentlemen, upon the attempt to establish the Society for which we are this night met, I was solicited to co-operate, to which I cordially assented. If this Society should be successful (as I sincerely hope it may), it must be by the interest which the working-classes take therein. *(Cheers.)*

Fellow Workmen, you must interest yourselves in its success: you, who live near enough, join the classes, and receive the benefit of the Lectures, the Library, Reading-rooms, and the Museum; and you who live at too great a distance, establish similar societies for your respective trades and localities, corresponding with what I have detailed to you to night, and depute some from among you to attend this Society, who will be able to convey the knowledge they receive to your societies. Thus will you accomplish the great desideratum—the universal happiness of all. *(Cheers.)*

It has been stated, and I believe truly, that the workmen in other countries are far in advance of the English in the Arts of Design. There is a system practised in certain trades in France, when youths are apprenticed; where, by agreement in their indentures, they are allowed to attend the Schools of Design a certain number of times per week, so that the study of the manipulations of their trades, and of the Art of Design may go hand-in-

Digitized by Google

hand and bring both to perfection. (*Cheers.*) If the English workmen will interest themselves in the success of Schools of Design, they will, ere long, be able to make similar terms for their youths; when our workmen will combat upon equal ground the boasted superiority of the foreigners, and with their acknowledged perseverance and industry we need not fear the result. (*Loud cheers.*)

Gentlemen, to prevent any mistake which might arise, I wish it to be clearly understood, that the payments to the classes are, for pupils under sixteen years of age, half-a-crown per quarter; for pupils above that age, four shillings; and for admission to the Lectures (which will be of first rate quality, and delivered twice a week, on Tuesday and Friday evenings,) the Library and the Museum only, two shillings and sixpence per quarter; that is, that those workmen who do not deem it necessary to put themselves under a course of instruction in any of the classes, can, by the payment of half-a-crown per quarter, attend the Lectures, the Reading-room, and the Museum. (*Cheers.*)

Fellow Workmen, there is an objection which I know most of you may justly urge against the cultivation of the Arts among you, which is the number of hours during which you are compelled to work daily for the support of your families. As one of yourselves, after years of serious reflection, having joined with you in the various societies which we have deemed necessary to support what we esteem our just rights, I do give you my decided opinion, that it is by the success of such societies as this is intended to be, that we shall be able to bring machinery to co-operate with benefit to manual labour (*hear*), so as to reduce the hours of labour; and that we may thus have, like other classes, a portion of time daily to appropriate for physical recreation, and to the improvement of the mental and intellectual faculties. (*Cheers.*) This will be the first step towards improving the condition of the working classes, and relieving many of them from a condition little better than that of beasts of burden. —(*Cheers*)

Gentlemen and Fellow Workmen; if you are desirous to quell those heart-burning contentions which so frequently occur between the employers and the workmen, I appeal to you to foster and support this and similar societies; for thus will you advance that glorious day when knowledge shall cover the land, as the waters cover the bed of the sea; (*cheers*) when true patriotism and the love of mankind shall glow in every bosom; and when the benefits of religion, morality, and education shall have convinced man, that there is a haven of peace and happiness for him, even here upon earth. —(*Loud cheering.*)

Mr. Foggo, and several other gentlemen addressed the meeting, but our limits will not allow of our giving their speeches.

## ELECTRICAL TELEGRAPH.

*To the Editor of the Penny Mechanic.*

SIR,—Reading in the 64th number (vol. 2) of your valuable periodical a passage on an electrical telegraph, I beg leave to offer a few observations on the proposed plan.

"L." has stated his plan to consist of a *small iron* pipe containing as many stout wires as there are letters in the alphabet (not mentioning figures). Now a metal pipe of any sort offers many considerations for its disuse. In the first place, each wire must, at least, be placed an inch and a half from any conducting matter, or the electric fluid would fly off at the first angle; and we do not suppose that he could or would have the pipes laid down in a line and on a level as the rail-roads. He has advised circular pieces of any non-conducting substance to keep the wires in their proper positions, which would hardly answer the purpose. Now a very large pipe would be necesssary, which I would propose to be properly coated in the interior with good wax; and that the wires be also coated or else placed within glass tubes and then kept in their places by anything. But I propose altogether as an improvement, that the wires be run through logs of *charcoal* (which is not generally known to be a non-conductor; and being not only one of the most imperishable things in nature, not being affected by the atmosphere or water; but one of the most economical.) properly bored. And that also the wires instead of terminating in nobs, should be attached to isoloted balls from which the fluid might pass off to the letters: this would prevent negligence, for the receiver must be watched night and day. I also consider a good *galvanic battery* would answer the purpose better than an electrical machine and leyden jars; saving time, trouble and expense. The improvements I have proposed are very simple, more economical, and obviate many of the faults of "L.'s" plan. Hoping this may be useful to some of your readers,

I remain, &c., THETA.

Digitized by Google

## ON TIMBER MEASURING.

*To the Editor of the Penny Mechanic.*

SIR,—In continuing the subject of Timber Measuring, I shall at once give the new approximated rules as put into my hands. Suppose all the mean girtings and measurements to be taken, and let G be the sum of all the girts, and $n$ the number of them so taken; then will $\frac{G}{n} = m$, be the mean girt; and the rule is $\frac{m)^2}{5} \times 2 - m \times 025 = A$, the approximate area of the compensating mean girt, which, multiplied by L, the given length, as $L \times A = Q$, the cubic quantity required. I must here observe, that it is impossible to give a direct algebraic proof of this rule, from the acknowledged fact of its being obtained by numerous trials and approximations, chiefly from the second rule, as given in Bonnycastle's Mensuration. In point of accuracy it is certainly much better; but again, it is much more laborious in practice, which it would be very desirable to avoid, as that is the chief objection to several other very accurate approximated rules. As to the accuracy of this rule, it is sufficiently tested by comparing it with the two results derived from other methods, there appears still to be some difference, but so small in comparison to the others, that it may be neglected. The following are the experiments:—

**No. 1.**

GIRTS.

1 = 38·6
2 = 38·5
3 = 37·7
4 = 38·0 } length 66·22
5 = 37·5
6 = 37·7
7 = 37·3

÷7 = 265·3 = G
37·9 = *m*.

**No. 2.**

GIRTS.

1 = 38·76
2 = 36·5
3 = 37·6
4 = 36·37 } length .. 72·5
5 = 34·42
6 = 34·00
7 = 35·00

7 ÷ 252·65 = G
36·0928 = *m*.

**No. 3.**

GIRTS.

1 = 28·5
2 = 28·3
3 = 28·6
4 = 28·0 } length .. 59·8
5 = 28·7
6 = 27·0
7 = 27·5

÷7) 196.6 = G
28·085 = *m*.

And the following are the mean girts divided by 4 and 5 respectively:—

| QUARTER MEAN GIRT. | ONE-FIFTH MEAN GIRT. |
|---|---|
| No. 1 = 9·475 | No. 1 = 7·58 |
| 2 = 9·0232 | 2 = 7·2185 |
| 3 = 7·02142 | 3 = 5·617. |

And the following are the actual cubic contents, as carefully determined by immersing them in a cylindrical tube, and gauging them, &c.

No. 1 = 7529·98
2 = 7442·026
3 = 3773·847

And the following are the cubic quantities, as determined by the new rule:—

Cubic quantity.

No. 1 = 7·58)² × 2 — 37·9 × 025
Multiplied by length = 66·22 } = 7546·9146.

No. 2 = 7·218571)² × 2 — 360928 × ·025
Multiplied by length = 72·5 } = 7438 556.

No. 3 = 5·61714)² × 2 — 28·0857 × 025
Multiplied by length = 598 } = 3731·67.

The following are the cubic quantities, as computed by the common rule:—

No. 1 = 9·475)² × 66·22 = 5945
2 = 9·02322)² × 72·5 = 5911 } omitting decimals.
3 = 7·02145)² × 59·8 = 2948

Digitized by Google

And by subtracting each series of results from the other, we shall be able to compare them and see the difference; the decimals may be omitted in every case, as in the last, which will not materially affect the accuracy of the result. That this rule will not be commonly used I think is very apparent, for the compensating decimal, 0·25, renders the operation very long; and unless the computers happen to be experienced arithmeticians, may lead them to erroneous results; not but that the rule is perfectly accurate, but, in practice, simplicity and dispatch is everything.

But although many objections may be raised against this rule on that score, I think there are many rules much more accurate than the common one, and not one jot more tedious. There are several short rules, tolerably accurate, in Hutton's and Bonnycastle's Mensuration, worthy of notice to practical men. I am also well convinced that it would be little short of madness in any one individual to attempt to carry any of these into execution, unless very influential, and dealing very largely in timber, and perhaps then not without incurring great losses; for centuries have so reconciled this error, that nothing short of a century can obtain a hearing on the subject amongst the principal dealers of this description. They have been bullied already nearly one century, and will stand another before they will give way. Landlords and land-owners are a sharp set in looking after their monies; it is something surprising to me that they don't keep their better eye open to their interests in this respect as well as they do in their rents. I am, &c.

TYRO LOCK.

---

*To the Editor of the Penny Mechanic.*

SIR,—With all due defference to the opinions of your very talented Correspondent, "Q. E. D." I beg (be it understood) without any presumption on my part, to make a few observations, and offer some suggestions for the perusal of your friend, chiefly relating to the collection of miscellaneous Scientific Questions in the Magazine of Oct. 21.

In speaking of the questions, by way of introduction, he says, "I do not consider any of them very difficult, and they *all* admit of *positive* and *incontrovertible* answers." Upon comparing this assertion with one or two of these questions, I am at a loss to find any *definite* answers. To be sure, perhaps I may be too thick-headed; but I have done my best to find these "positive and incontrovertible answers," and, after all my cogitations, what result do you suppose I arrive at? why, that "Q. E. D." has positively been too positive in arriving at *his* conclusions; that he has set them down in too much haste, and not closely considered whether they do really admit of these positive answers or not. The questions that I allude to are 9 and 13. 'In regard to 9, he says "it is stated in a *foolish* work lately published, that if there were no atmosphere, a person turning his back to the sun would be in total darkness." This is very *foolish* of "Q. E. D." The *foolish* work thus alluded to is Chambers' edition of Paley's Theology, chap. 21, art. 1, where these words occur,—"If I had the power of seeing *only* by means of the rays coming *directly* from the sun, whenever I turned my *back* upon the luminary, I should find myself in darkness." And this question *is to be* "incontrovertibly" controverted, which "Q. E. D." *promises* to do. Till this *is done* it cannot be expected for me to say anything in contradiction; for perhaps he can do it. Paley evidently presupposes the non-reflective powers of the atmosphere to be a consequence upon which his imaginary hypothesis is framed, and upon which the supposition depends for the truth.

What, "Q. E. D." do you, a Cantab too, dare to *rebel* against one of the most gifted of Alma Mater's sons? Oh, no! this cannot; you know Paley too well to slight him thus. Knowest thou not that Shelley studied Theology, and was still expelled for atheism. His fertile genius led him beyond the bounds of truth; imagination took the place of reality, and taught him more than ever dogmatic Oxford knew, and more than ever they wished him to know: in fact he was sceptical,—so am I; but pray do not expel me from the pages of your little Magazine for thus daring to opine to myself the liberty of opposing opposition. I do not mean, for I am well aware that to attempt to oppose one of the, not least "opaque" of Alma's sons, I should run the risk of a good drubbing: besides, I am of a very pacific disposition myself, and should cut but a sorry figure at "thrust and parry" with "Q. E. D." But an opinion dropped by way of suggestion surely cannot provoke the ire, even of one of the most ireful, and much more "Q. E. D." In regard to 13, I am rather at a loss to think whether any one of your readers can give a positive and incontrovertible answer to it, for I have perused many books of the highest authority without being able to

Digitized by Google

find any definite answer. To be sure, every author looks upon his opinion and answer as perfectly correct; so that, according to this, they are all correct. I know which out of the lot I should choose, and I dare say that both "Q. E. D." and myself are of the same opinion. The mistaken philosophers are, no doubt, numerous; perhaps this may be something of a philosophers' stone: be they what they may, come from where they may, that is a point not yet satisfactorily answered.

I am looking forward to an able solution of these questions by their talented proposer, who appears every way qualified for such an undertaking. Here I will quit this "foolish" subject, and step to something of not so much importance, perhaps, but more immediately interesting the greater part of your readers. And first, I beg to suggest to "Q. E. D." that such questions as he has here proposed are not calculated to excite any attention from practical mechanics, in consequence of their not being in any way connected with their interests; had they been on the application of mechanics to the arts, they would probably, ere this, all have been answered. Of what service are questions 5, 8, 9, 10, 13, 15, 18, to any practical man when answered? None. Suppose then, "Q. E. D." you give and take some practical questions that may be applied usefully. And, in conclusion, I must beg of "Q. E. D." to continue his excellent commentary on Mechanics, and hope soon to see him advanced in the matter; of all the branches of mathematics the definitions of none, save the Differential Calculus, are so imperfect and ambiguous as Mechanics. Perhaps "Q. E. D." will undertake to explain some crusty definitions in the calculus.

In regard to question 4, I have many observations to make, which will interest all parties. The question, as there given, is rather imperfect; some dimensions of the quill should have been given. In the Differential Calculus "Q. E. D." might explain the theory of adfected equations, which, like the theory of indeterminate co-efficients in algebra, are not explained in such books as are likely to fall into the hands of a tyro in mathematics.

Yours, &c. TYRO LOCK.

## ELECTRICAL TELEGRAPH.

*To the Editor of the* PENNY MECHANIC.

SIR,—It is so thankless a task to depreciate the ingenuity of others, that it is desirable to avoid even the appearance of it as much as possible. I should not therefore presume to offer any strictures on the communication of your ingenious correspondent "L." in your Magazine, relating to an electrical telegraph, but that I hope, by so doing, to stimulate his inventive faculties, and enable him to render the apparatus he proposes to construct more perfect than it otherwise will be.

The communication of letters by post is so rapid and so regular in this country, that it appears to me there are very few persons who will desire that *private* correspondence should be carried on by means of the proposed telegraph. The use of it, if constructed and found to answer, will, most probably, be confined to Government and large commercial firms, to whom the rapid communication of news is of importance. I conceive, therefore, that there is little or no occasion for employing the alphabet, as proposed by "L." A few arbitrary characters would probably be found more convenient, and would reduce the expence of constructing the telegraph, besides lessening the probability of its getting out of order, as will be seen by what follows; and if private individuals should wish to communicate by the telegraph, instead of by letter, the use of the characters could soon be learnt.

This, however, is a point of minor importance, compared with the difficulty of keeping the wires, along which the electric fluid is to pass, in a perfect state of repair. Suppose one of the 24 wires, extending from here to Edinburgh, as proposed by "L." to be separated at any part for the length of an inch or two, the consequence will be, that the electric current will not pass, and the telegraph will be rendered nearly useless. It will be rendered useless so far as regards *the letter*, which is affixed at the end of the broken wire; and omitting a letter in spelling a word may produce mistakes of great importance. We see, therefore, it is very desirable to have as few wires as possible, and hence the use of arbitrary characters over the alphabet. It may be said, perhaps, that the broken wire can soon be joined, and therefore the inconvenience will not be great. But how is it to be found out *what part of the line the wire has broken*, if it is to be two or three hundred miles long, and enclosed in a non-conducting case? This appears to me to be a difficulty of great importance, and one which must be provided for before the telegraph can become the useful instrument anticipated by its inventor. The liability to accident may not be great,

Digitized by Google

but in a wire of such a length it appears impossible to provide against entirely. Probably "L." or some of your correspondents, can point out a means for ascertaining at what part the wire has broken. I confess it appears to me a work of some difficulty. Probably electrometers, placed at regular distances along the wires, might assist, but this can only be determined by experiment.

I am, Sir, yours obediently,
N. S. N.

*To the Editor of the Penny Mechanic.*

SIR,—I beg to inform your Correspondent, "John Miles," that his notice of propelling boats by means of a spiral screw running longitudinally through the vessel, is *not* new, for it has been tried some years ago, and I believe did not answer. The construction is as follows:—A spiral worm or screw is coiled round a shaft or cylinder, so that the angle of inclination which the worm makes with the axis of the cylinder continually increases throughout its whole length. The action is thus,—on the paddle being made to revolve in the water, the commencement of the spiral blade, or that part of it which forms the greatest angle with the shaft, acts upon the water, and gives it an impetus or motion towards the back end of the paddle, thus creating a current in the direction of the spiral. If this current were to reach the succeeding or following part of the spiral paddle before those parts take their action upon the water, such following parts would move in or keep pace only with the current, and therefore meet little or no resistance from the receding water, and a part of the whole of their action would be lost. But by progressively elongating the pitch of the spiral, each succeeding part of it begins to act before it is overtaken by the current given to the water by the action of the preceding part of the spiral, and consequently every part meets a proper resistance from the water, and thereby gains a portion of propelling power. This is substantially abridged from "Partington's Steam Navigation," where figures, &c., are given, and to which I beg to refer your Correspondent. It is very plain that such a machine is not at all adapted for rough seas; it may do for smooth canals, but nothing more.

And, *en passant*, I beg to offer a few remarks upon the very notable invention of your Correspondent "W. P. F." in No. 63 of the Penny Mechanic, who supposes that he can obtain a perpetual motion from a machine which anybody may see, at a glance, he cannot obtain *any motion at all*. His machine, as in his diagram, is directly contrary to every principle upon which the syphon acts. He ought to know that one leg *must* always be longer than the other before it is possible to obtain any motion whatever; whereas each leg of his machine, in both syphons, are equal, and both glasses at equal elevations, which is just as absurd as the other. There is a similar notice in one of the numbers of vol. I. which is much less objectionable than this, but both are in error as to the means of obtaining motion. We are certain that neither "inventors" ever tried their schemes, or else they would never have the temerity to send such whimsical nonsense to you for insertion; and we cannot too severely reprobate such conduct, in sending schemes which they have never attempted to prove, and which a little consideration would teach the absurdity of their propositions. If your Correspondents want a perpetual motion, they may find a very near approximation in the floating tide mills of Holland and elsewhere, which keep in motion as long as the materials endure and the ocean itself reciprocates; when these cease, then farewell to all motion. But I fancy, without any bias, these do really make the nearest approach to perpetual motion.

From these hasty remarks it must not be understood that I wish to deter others from sending their inventions to your pages, be they ever so immature; no, send them by all means, and if capable of improvement let it be done by others. But I am certain that no one in their senses would send such stuff to print as that of "W. P. E." And I must at the same time beg leave to say, that I have in no way alluded to the notice of your Correspondent, "John Miles;" that is perfectly rational, and perhaps, by some yet unknown adaptation, may be brought to bear the test of practical application, &c.

Yours, &c. TYRO LOCK.

*Birmingham Railway.*—Eighty miles of this railway is now finished, viz. from Birmingham to Rugby, thirty-two; and from London to Stoney-Stratford, forty-eight. It is said that the Kilsby tunnel, on this line, will cost at least 400,000*l*. The Coventry district, we hear, is also finished.

*Hayle and Redruth Railway.*—The railway embankment across the valley between Carn Brea and Redruth is very nearly finished, and the carriages will soon run on the whole line.—*West Briton.*

Digitized by Google

# THE CHEMIST.

## IODINE.

M. Courtois, a soda manufacturer at Paris, discovered iodine in 1812. In preparing carbonate of soda from the ashes of sea-weeds, he noticed that the metallic vessels were strongly corroded by the residual liquor; and, on examining the cause, he observed that sulphuric acid precipitated a dark-coloured matter, which, on the application of heat, was converted into a beautiful vapour. Struck with its appearance, he gave some of the substance to M. Clement, who thought it was a new body, and the year afterwards described its principal characters in the Royal Institute of France. Gay-Lussac and Davy, however, determined its real nature, who proved that it was a simple non-metallic body, similar to chlorine. It occurs in many mineral springs, in combination with potassium and sodium. It has been detected in the water of the Mediterranean, in sponges and the fuli class of sea-weeds. Vanquelin also found it in the mineral kingdom, in combination with silver.

All the iodine of commerce is procured from *kelp* (impure carbonate of soda, which is prepared by incinerating sea-weeds.) Soap-makers use kelp for the preparation of carbonate of soda; and the dark liquor remaining after that salt has crystallized, contains a large quantity of iodine, combined with sodium or potassium. On adding a sufficient quantity of sulphuric acid, hydriodic acid is first generated, and then decomposed. When the solution is boiled, the iodine sublimes, and may be collected in cool glass vessels. Dr. Ure recommends us to use an excess of sulphuric acid, and then add some peroxide of manganese, which will act on the hydriodic acid in the same way as on hydrochloric. At the usual temperature of the atmosphere it is an opaque, bluish black, scaly substance, with a metallic lustre, an acrid taste, and the odour of chlorine, but less pungent; stains the fingers brownish yellow, crystallizes in a rhombic octo hedron, but sometimes in large rhomboidal plates. Dr. Thompson found its specific gravity to be 3-0844, which differs greatly from that of Gay-Lussac, who states it to be 4.948. It sublimes at a heat much under 212°, fuses at 224½°, and boils at 347°. Its vapour is of a very rich violet colour, from which it owes its name.

Iodine is a non-conductor of electricity, and a negative electric. It requires for solution 7000 parts of water, to which it communicates a brownish tint: alcohol and ether dissolves it readily, forming deep reddish brown solutions. It destroys vegetable colours, though in a much less degree than chlorine, is not inflammable; but under certain circumstances may be made to unite with oxygen. Chemists are unable to resolve it into more simple parts, and consequently it is regarded as an elementary body. Its chemical equivalent is 126.3. It is distinguished from all other substances by the violet colour of its vapour, and by its property of uniting with starch, and forming a deep blue-coloured compound which is insoluble in cold water. This test detects the presence of iodine in a liquid, containing 1.450.000 of its weight.

## CARBON.

If wood be heated to redness in close vessels, so that atmospheric air can have no access to it, a large quantity of gaseous and other volatile substances is expelled, and a black, hard, porous matter is left, called *charcoal*. It may be procured from other sources. The substance called *coke*, which remains in the retort in the process for making coal gas, is a peculiar kind of charcoal. Most animal and vegetable substances yield it when ignited in close vessels. Animal charcoal is prepared by making bones red hot, in a covered crucible; a black mass remains, which consists of charcoal mixed with some earthy salts, that may be separated by adding dilute hydrochloric acid, let it stand for two days, then pour off the supernatant solution, and wash frequently with distilled water; lastly dry it.

Charcoal is a hard, brittle substance, a bad conductor of heat, but a good one of electricity. Insoluble in water, and very little affected by the acids or alkalies. It possesses the power of absorbing a large quantity of air or other gases at common temperatures, and of yielding them again when heated. This effect cannot be attributed to chemical action, but is owing to its peculiar porous texture. It likewise absorbs the colouring and odoriferous principles of most animal and vegetable substances. Charcoal is combustible; when heated in the open air, it burns slowly; but in oxygen gas, it is very lively, and accompanied with the emission of sparks. In both cases the product is the same, viz. carbonic acid gas.

Carbon is the pure, inflammable principle, which is the characteristic ingredient of all kinds of charcoal. Wood-charcoal is very impure, likewise coke. The diamond is carbon in a state of absolute purity. Pure carbon, the diamond,

Digitized by Google

is prepared by the hand of nature, crystallized in octohedrons; it is intensely hard, and refracts light powerfully; a circumstance which suggested to the illustrious Newton its combustible nature. When submitted to a high temperature in oxygen gas, it is entirely consumed, and carbonic acid gas formed. Its chemical equivalent is 6. Lavosier first proved it to contain carbon by throwing the sun's rays, concentrated by a powerful lens, upon a diamond contained in a vessel of oxygen gas. The diamond was consumed, oxygen disappeared, and carbonic acid was generated.

## NITROGEN.

We are indebted to the late Dr. Rutherford, of Edinburgh, for the first account of this gas in the year 1772. Lavoisier and Scheel, in 1775, discovered that it was one of the constituents of the atmosphere. Lavoisier called it *azote*, because it could not support respiration; but since it possesses this quality in common with many other gaseous bodies, it has received the appellation of nitrogen, from the fact that it is an essential ingredient of nitric acid.

Nitrogen may be obtained most conveniently by burning phosphorus in a jar, full of air, inverted over water. The strong affinity which exists between phosphorus and oxygen, enables the former to burn until the latter is consumed. The metaphosphoric acid which is formed is rapidly absorbed by the water; the nitrogen gas contains a small quantity of carbonic acid and vapour of phosphorus, which may be got rid of by shaking it briskly with a solution of potash. The most economical process is to expose a mixture of fresh muscle and nitric acid to a moderate temperature. Effervescence ensues, owing to the escape of gas, which is nitrogen mixed with a little carbonic acid. This may be removed by agitation in lime water. This gas when pure is colourless, having neither taste nor smell. It does not possess any acid properties, is not a supporter of combustion, nor inflammable like hydrogen, though it may be made to unite with oxygen. Its specific gravity is about 0.9722. Water absorbs about one and a half per cent. of it. Its chemical equivalent is 14.

## CYANOGEN.

Cyanogen gas was discovered in 1815 by Gay-Lussac. It is prepared by heating bicyanide of mercury, dried, in a glass retort. This bicyanide is composed of one equivalent of mercury, and two of cyanogen. On the application of heat it is resolved into its elements, the mercury is sublimed, and the cyanogen passes over in the form of gas.

Cyanogen gas is colourless, has a strong pungent and peculiar odour, is one of those gases which Dr. Faraday has succeeded in condensing into a liquid. It is inflammable, and burns with a beautiful purple-coloured flame; does not support combustion. Cyanogen is a bicarburet of nitrogen, i. e. composed of two equivalents of carbon, and one of nitrogen. It was called cyanogen by Gay-Lussac, because it is the principal ingredient of Prussian blue.

Clitheroe. JAS. THOMPSON, JUN.

## ON GOLD.

SIR,—As everybody is very anxious to possess gold, it may be probable that a short account of the method of obtaining this valuable metal may not prove uninteresting to your readers. I shall more particularly describe the Virginian gold districts of America, where of late an extensive field has been opened to mining enterprise. The hills in the gold districts of Virginia are generally not very high, say from 150 to 200 feet, and exhibit but few precipitous faces, except on the rivers. The talcose, chloritic, and schistose rocks, when exposed to the usual action of the ordinary atmosphere *disintegrate*, and the results are occasional beds of *plastic clay*, from which bricks can be made; I beg the geological student to pay attention to the above remarks, as it will be subsequently found of considerable importance and utility. The rocks that shew themselves on this tract, and throughout the gold region of Virginia, are talcose and chloritic shales, they have all a general direction from about south-west to north-east; they are highly inclined, deviating from the perpendicular only about ten degrees, the prevailing dip is eastward. I further beg the student to compare this and the above, and also Lyell's and Phillips's geology on the primary strata, and judge for himself whether, generally, aqueous or igneous agency is the most probable in accounting for the deposition of the upper of the primary rocks or shales; this is a fertile field for the due exercise of a lively imagination. The latter of the preceding remarks display evidently the emptive action of igneous agency in upheaving the stratification to the extent there mentioned; it is scarcely possible, I think, for aqueous agency to have produced such intense effects.

Digitized by Google

The talcose state is here generally a rock which divides into long thin lamina with a silk-like lustre, having that usual unctuous and talcose touch that characterises magnesian rocks. It is of easy disintegration at the surface of the earth, under which circumstance, it assumes a brick red colour; and beneath the surface, where the humidity is not driven off by the action of the sun's rays, it is tenacious and clayey. At still greater depths it is less disintegrated and is of a greyish green hue. When silicious matter predominates, the rock becomes harder, and frequently so as to give sparks with steel. This class of rock varies at every step; chlorite becoming abundant, the rock becomes green; ferruginous matter, in greater or less abundance, gives a variety of red tinges when sufficiently near the surface to be acted upon. In the space but of a few yards, a multiplicity of colours are exhibited, the earthy character of the rock remaining the same. In the majority of cases these talcose slates may be worked with pick and spade. At times the rock loses somewhat of its schistose structure, and becomes petro silicious, when it requires blasting to be worked. These rocks sometimes pass into steachistes with amranthus; at other times they assume a serpentine appearance, and pass into a well-characterised jade, out of which the Aborigines formed their arrow and spear heads. Masses of milky and ferruginous quartz are scattered over the surface, and the land is traversed by auriferous veins. Fragments of several of these display the gold visible to the eye, from other veins no gold can be extracted; these last are therefore called barren veins. The veins of auriferous quartz follow the general direction of the rocks running parallel to the blue ridge and Alleghany Mountains, their direction being about south-east and north-west.

These veins appear to be of the nature of those termed by the German "leigende stick," or in other words, are considered to be contemporaneous with the formations in which they are found to exist; being parallel to the stratification, and having no other walls than those of the rocks between the layers of which they have their course. The dip of those veins, in all cases, accords with the inclination of the enclosing rocks.

The different mineral substances which are observed in these quartz veins, are native gold, sulphuret of iron containing gold, hydrate of the peroxide of iron, also containing gold, specular oxide of iron, milky and dusty quartz, quartz hyalin, cyanite, &c.

The gold is found disseminated in different sized particles, sometimes so fine as not to be visible to the naked eye, but which can be obtained by the usual process of amalgamation, the means of doing which I may perhaps describe in another paper. The quartz in these different veins has a general resemblance; it is sometimes white or blue white, rose coloured, massive, and containing more or less of the auriferous sulphuret of iron, the latter substance is often wanting, leaving in its former position a portion of the hydrate of the peroxide of iron, which falls occasionally, and sometimes ore appears in the pseudo-morphous cavities once occupied by the pyrites. Portions of this quartz are fusible, and like a sponge, traversed in every direction with vacuities or cells, once filled with the auriferous sulphuret of iron, which has long since disappeared, leaving the indecomposable quartz with a rugged dirty structure, and having a thin coating of gold lining the facits of these cells, and particles of the same metal of various sizes. This accidental appearance of the quartz is often called honeycomb, or cellular quartz, and is always regarded as a *good indicator* of gold. Crystals of the specular oxide of iron are found associated with the auriferous quartz. Most of the veins are composed of masses of quartz, very much interspersed with the pyritical cubes of auriferous iron, and also a great variety of cellular quartz, out of which the cubes of the pyrites have long since been decomposed, and have vanished by some recent process of nature, as if the decomposed iron had been converted into a fluid and filtered through the mass, colouring with iron the talcose slate walls of the vein; indeed, all the ferruginous quartz appears coloured by this filtered iron. One circumstance remains to be noticed. Strictly speaking, these veins so called, are rather distinctly stratified contemporaneous masses, coextensive with, parallel, and continuous with the whole series with which they alternate uniformly, with much apparent diminution in their average thickness, however they may differ in their metalliferous character, as they extend *many miles;* and, as already stated, conform to the Alleghany Mountains.

I have already observed that these veins and lodes are nearly perpendicular, which is something very remarkable in these primary rocks, displaying evidently traces of immense eruptive violence, so much so, that supposing it to have been occasioned by igneous agency (which is the most probable case), these veins must

Digitized by Google

have been projected with immense force, or otherwise settled vertically through the mass whilst in a state of complete fusion, by their superior gravity. I think it is beyond doubt, but that the primary rocks have all, more or less, been acted on by an intense igneous agency, and that they have been in a complete state of fusion at *some time*.

TYRO LOCK.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*The Meteorological Society*, Mechanics' Institution, Southampton Buildings, Holborn.—March 13, (Anniversary Meeting).

*Tower-street Mutual Instruction Society*, 16, Great Tower-street.—Feb. 26, W D. Saull, esq., on Astronomy.

*Southwark Literary Society.*—Feb. 28, T. J. Serle, Esq., on Shakspearian Readings.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Can any of your intelligent Readers favour me with the best and briefest definition of the term "perpetual motion."—Also the cheapest and simplest method of making "chrome yellow for paint."

Yours, &c.

DERFLA KRALC.

*Tracing Paper.*—SIR,—I have made the foregoing after the receipt given, but it is a considerable time drying, and when apparently so, on the paper being put together sticks; added to which, the strength of the oil (smell) is offensive, and does not evaporate but continues. Perhaps the intelligent Correspondent will advise what can be done to counteract the strong odour, and promote the quicker drying of the paper?

INQUISITOR.

Sir,—Will you have the goodness to inform me the method of rendering the surface of prints washable; by varnishing or any other means?

THO. INLAND.

[See Penny Mechanic, Nos. 45, 53.]

Sir,—Can any of your numerous Correspondents inform me what colours will produce the following tints for architectural drawings: viz. red and grey brick work; stone work; compo; glass; mahogany and wainscot?

G. T. M.

Sir,—I should feel greatly obliged to any of your Correspondents who could inform me the best method of making the balls for roman candles; the blue balls I mean, such as we see on Summers' evenings at the different places of amusement.

Also of the best manner of joining the gores of paper balloons, not the cement for sticking them together, as that I well know: but there is a method of joining them together very quickly, which I am not acquainted with.

J. E. GODDARD.

Sir,—What is the price of a small Leyden phial, and where can it be bought? or if any of your Correspondents have one to dispose of, what price?—

What will be the price of the "plate glass wheel" of the "cheap electrical apparatus," mentioned in No. 48, and how large must it be?

Also, what price tin foil is per foot.

Yours obliged,

K. T. Y.

[A Leyden phial can be bought at Palmer's, Newgate Street, for 3*s*. 6*d*.—Tin foil 3*d*. per oz.]

Sir,—You will oblige me by inserting the following in your valuable magazine: Which is the most simple method of making a gasometer?

Also, whether a vessel made of glass or lead is the best for making hydrogen gas in?—Whether common lime is used for the oxy-hydrogen microscope? and also if there is any danger in making the above gas?

GLANCUS.

## ANSWERS TO QUERIES.

SIR,—Observing in a late Number of your useful Publication, an enquiry for the proper method of combining "essence of lemon with water," I beg to state that it may be done simply by rubbing down, or triturating in a marble, or composition mortar (such as are commonly used by druggists) a few drops, say from twenty to thirty of the essence with a little loaf-sugar, or about a table spoonful of magnesia will answer the purpose; and after thoroughly mixing the essence with the sugar or magnesia, add at intervals, (stirring after each addition) a pint of distilled, or clear soft water; then filter through the common filtering paper, which may be obtained at any druggists.

DERFLA KRALC.

Sir,—A Correspondent asks where the bottle was cast. I do not exactly know, but very probably at the Star Foundry, Great Dover Street. The bottle of course was *not* cut in half. Half was moulded in the upper and half in the lower box, and a core inserted before the boxes were pinned together. The one I speak of was cast twelve or fifteen months ago, when iron was much cheaper than it is now, so that the necessary allowance must now be made, say fifty per cent.

C. D. T.

*Plate Powder*, Sir, is Venetian red, or red oxide of iron finely powdered. Prepared by adding a solution of potash or pearlash to a solution of sulphate of iron (green vitriol), and then drying and igniting the precipitate.

C. D. T.

Sir,—In answer to your Correspondent "J E." I beg leave to inform him that diluted sulphuric acid well and frequently rubbed into the pores of the hands particularly if mixed with a *small* quantity of soap will protect the hand from fire. Cloth steeped in a strong solution of alum will resist combustion, and by frequently singing or compressing the hand: but the best of all is a few fibres of amianthus worked in cotton cloth, &c. at some distance (say a quarter of an inch) from each other, or imbedded in a calcareous paste, will have the desired effect.

Yours, &c.

THETA.

## TO CORRESPONDENTS.

J. B. A. *We know of no channel through which he could procure a patent without money; and it must be a good round sum too. If, however, he will entrust us with an outline of his plan, and we find a sufficient degree of ingenuity and originality in it to merit public notice, the attention of the wealthy and mechanical portion of our readers shall be called to it, by an appeal, in our Magazine.*

E. S. *must also be content in his station, until the Patent Laws are remodelled.—2nd. The engine he mentions would be of no use to him.*

A Subscriber. *We have heard that several persons have had their eyesight injured, in passing through railway tunnels, in consequence of the use of coke. In our opinion the legislature ought not to sanction tunnelling, unless an open cutting could be made every quarter of a mile. Shafts are of but little use, either as a means of giving light, or in acting as ventilators.*

Mr. Thomas *has left a letter at our Office for* Mr. Mathews, *which he can have by calling on us.*

Received, C. D. Thomas.—W. H. W—n.—Z. Wigo.—L., &c.

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,

## AND THE CHEMIST.

No. LXXII.] SATURDAY, MARCH 3, 1838. [Vol. II.

### GAS APPARATUS.

FIG. I.

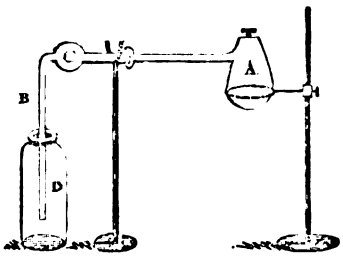
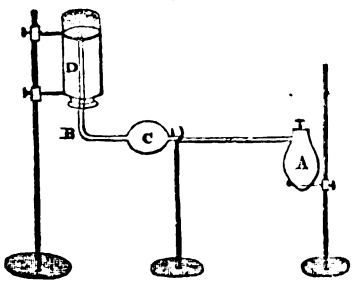
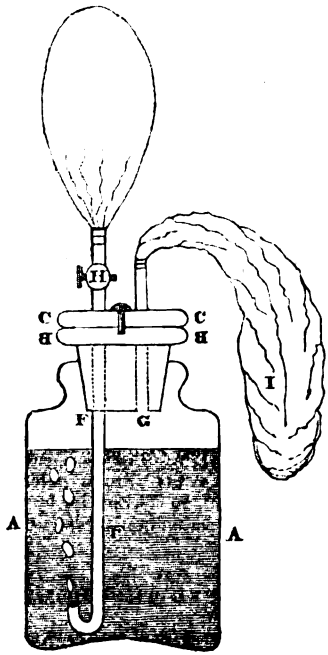



FIG. II.



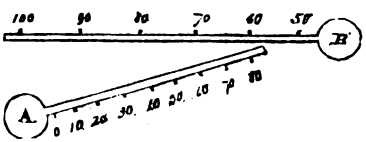

### GAS COLLECTOR.

FIG. III.




### REGISTER THERMOMETERS.

FIG. IV.




Vol. II.—No. LXXII. Holloway Press: D. A. Doudney.

Digitized by Google

## ON THE NATURE AND PROPERTIES OF STEAM.

NO. V.

VIS VAPORIS.

THE Franklin Institute, while experimenting on the causes of steam-boiler explosions, deduced from actual experiment the following results, relating to the temperature and corresponding pressure of steam, given in the following table. To which is also added that of the French Academy. The Franklin Institute being lower, as regards the temperature necessary to produce steam of any given pressure, than the French. On account of the great difference they repeated their experiments, but found them to be correct.

| Pressure in Atmosph. | Franklin Institution. | French Academy. | Difference | Pressure in Atmosph. | Franklin Institute. | French Academy. | Difference. |
|---|---|---|---|---|---|---|---|
| 1 | 212· | | | 6 | 315·5 | 320·4 | 4·9 |
| 1½ | 235 | | | 6½ | 321 | | |
| 2 | 250 | 250·5 | ·5 | 7 | 326 | 331·7 | 5·7 |
| 2½ | 264 | | | 7½ | 331 | | |
| 3 | 275 | 275·2 | ·2 | 8 | 336 | 342·0 | 6· |
| 3½ | 284 | | | 8½ | 340·5 | | |
| 4 | 291·5 | 293·7 | 2·2 | 9 | 345 | 350·8 | 5·8 |
| 4½ | 298·5 | | | 9½ | 349 | | |
| 5 | 304·5 | 308·5 | 4·3 | 10 | 352·5 | 358·9 | 6·4 |
| 5½ | 310 | | | | | | |

As steam, by condensation, suffers a very great diminution of volume, it is an efficient means of producing a partial vacuum, without the application of mechanical force. And this is the principle of all low pressure engines, whether atmospheric, single or double. For as a cubical inch of water expands into a cubic foot of steam at 212°, so conversely, by condensation, it will be reduced to its original volume. And if this condensation take place in a closed vessel, a vacuum (imperfect of course) will be produced, and the atmosphere will press against the sides of the vessel with a force of fifteen pounds per square inch, supposing the vacuum perfect; but from imperfection in this respect, friction, uncondensed steam, &c. it is considerably reduced.

C. D. T.

## IMPROVED THERMOMETER,

Showing the state of the Temperature, at any hour of the night without the aid of Artificial Light.

*To the Editor of the Penny Mechanic.*

SIR,—This beautiful and elegant instrument has many advantages over the common mercurial thermometer, especially in making nocturnal observations.

It differs from the common mercurial thermometer in having a narrow streak of white enamel in the curve of the thermometer, immediately behind the bore, which serves as a reflecter to the quicksilver within. The figures on the graduated scale are of pearl, which is placed upon a black ground, as ebony, or other hard substance, and thus become distinctly visible; and the true state of the temperature may be accurately read off without the aid of lamp or candle, at any hour of the darkest night.

The materials of which this instrument, and the scales are constructed, possess this great advantage, they will neither oxydize nor corrode. This instrument may be seen at the inventor's, Mr. R. C. Wood's, Meteorological Instrument Maker, No. 47, Hatton Garden.

It was exhibited at the Meteorological Society on Tuesday evening, the 13th inst. before a numerous and highly-respectable audience. Many gentlemen tried it, by placing it in the darkest parts of the room, and all agreed, that, *the darker the place of observation, the more distinctly was the temperature read off.* W. H. W.

## ON COMBUSTION.

SIR,—In your last Number, I perused an article, the writer of which endeavours to

Digitized by Google

prove, "that placing the poker across the fire, does not in reality accelerate the combustion, but that we only imagine such effect to be the case." He further observes, "The idea of a cold bar of iron imparting to the coals an aptness for combustion, cannot I think be entertained; neither can it promote the current of air through the fire, so long as it remains colder than the surrounding air; but will, on the contrary, retard the ascending column, by absorbing its heat, and consequently condensing it."

Has your Correspondent never remarked, that if a pole be thrust into the ground, at a moderate distance from a climbing plant, the plant directs its course towards the pole, lays hold of it, and rises to its natural height. Again, a small plant placed under the shade of a larger one, is unhealthily drawn up beyond its strength. And again, if the hand be placed over a candle whilst burning, at a moderate elevation above the flame, it immediately shoots up towards the hand. With deference to your Correspondent I would submit, that the fire being drawn up by a bar of iron placed over it, is not more wonderful than the flame being drawn towards the hand, or the plant towards the pole, and there are few, if any individuals, who have not had ocular proof that such is the case.

Are we to reject, as fallacious, all phenomena, for which we cannot account? Certainly not,—so doing, would (in other words) be saying, that science has arrived at its climax, and that every discovery which *can* be made, *has* been made. Such is well known not to be the case; continual additions are happily being made to our stock of scientific, and useful knowledge, (and not a few by those whose depressed situations in life have deprived them of the benefits of education). Natural philosophy is still, and always will be, in its infancy; we are truly told by the poet:—

"There's no perfection here below."

Nor is there. Successive discoveries in physics may solve these enigmas. In the meantime I must beg to state, that I do not consider the fact, "that placing the poker across the fire assists combustion," at all invalided by the attempted explanation of your talented Correspondent; and I can scarcely believe that there is another person in Great Britain, besides himself, who ever doubted the circumstance.

I am, Sir,
Your obedient servant,

VANDERKISTE, JUNR.

## LECTURE
### ON
## MECHANICAL AGENTS.

BY DR. LARDNER.

On the 23rd instant Dr. Lardner delivered a lecture on mechanical agents, at the Mechanics' Institution, Southampton-buildings, the substance of which was as follows:—

The subject to which he called the attention of the audience was heat. This is a very powerful and universal mechanical agent, an agent, indeed, far surpassing any other in the great and splendid effects which it produces; it is the main source of the greatest power that is known in the present day; its powers and effects are to be witnessed everywhere. To the arts and sciences it is a source of power as indispensible as it is invaluable; it is, in short, an almost infinite power. The geral properties upon which heat acts, is by expansion or increase of volume, and, in some contrary instances, by contraction, but in most practical applications it is by expansion. Suppose that we have a bar of iron of known dimensions, and heat is applied to this, it will soon be seen that the mechanical action of the heat will increase the length and depth of the bar, and consequently increase its volume, and this expansion is almost irresistible; for if we place the old bar between two fixed objects, sufficiently strong to resist the longitudinal expansion of the bar, the bar will either break or bend; but since it expands in breadth and depth, this will materially resist it and keep it from bending, the consequence is the bar will fracture. Another common illustration that he advanced was, that of fastening on the iron rim or tire of a wheel; it is commonly known, that in this the rim is made rather less than the circumference of the wheel which it is to go on; the rim is then made red hot, which, as already stated, considerably enlarges the circumference of the rim, so much so, that when red hot it is probably as much too large as it was before too small; it is now put on the wheel, and suddenly cooled by throwing water upon it, which contracts the iron to the same size that it was before it was heated, and, thus contracting, it binds the wheel with an irresistible force, much stronger than could ever be obtained by any other method. In the East, the natives use it as a mechanical agent in the stone quarries; and the most splendid effects are produced

Digitized by Google

by it in the application about to be detailed: when they want to quarrie or obtain a block of stone of remarkable size, they proceed as follows:—They clear the superstratum or soil from the rock, and lay its upper surface completely bare; they then mark out the size of the block required, and on these marks they chip out a small channel, in which they put ignited charcoal, or any other combustible substance, of course the more heat they can obtain the better; they continue this fire till the rock becomes tolerably hot, and to a considerable depth under the channel thus marked out; when they imagine it to be sufficiently hot, they sweep off the ashes and cool it as rapidly as they can; the sudden contraction rends the rock along the channels thus marked out, and by this method they can obtain blocks of almost any dimension. This is a very fine illustration of the gigantic powers of this agent. These properties of alternate expansion and contraction have been taken advantage of in a still more extraordinary way; the walls of a large building in France, the Abbey of St. Martin, were giving way, or being forced from the perpendicular by the pressure of the roof, and the expansion of iron was applied to restore the walls to their perpendicular position again. Holes were bored in the walls at different intervals, directly opposite to each other, and through these holes long bars of iron were passed and screwed by plates in the usual way on the outside of the wall, as tight as any mechanical force could screw them; this done, a row of lamps was placed under every other bar, and thus one half of the number of bars became red hot, and consequently expanded, and the plates that were screwed tight to the wall when cold, were now forced from the wall by the expansive agency of the heat; they were again screwed tight to the wall, and the lamps removed. The bars, of course, contracted, drawing by their contractile force the walls more perpendicularly; the other bars were now heated, and the same process of heating and cooling alternately continued, till the walls were raised to their perpendicular. These walls are now standing safe and sound, and, strange enough, the building has been converted into a Mechanics' Institute, as if to commemorate the event. The next was the application of heat to the manufacturing and dressing of fine cloths, laces, net-work, &c. This, at first sight, would appear as paradoxical as it is astonishing; the finest cloth, and net-work of the most delicate texture, are actually made to pass over a red hot iron. One would certainly imagine, that the net-work would either be singed or completely burnt, but this is altogether a *matter of time*, the process is this:—when the net-work, &c., quits the twisting or weaving machine, it is rough, and every individual thread is surrounded by a rough coating of fine filaments, something like the fine under down of small feathers, which must be cleared off; for this purpose the manufacturers have recourse to fire. The net is wound from one reel on to another, and in thus being wound, touches the cylinder also revolving at a great velocity, and the filaments coming into contact with the hot cylinder, are singed off, whilst the threads themselves are not touched; all this is a matter of *time*. If the lace or cylinder moved too slow, the lace would be burnt, and, on the contrary, if they moved with too great a velocity, the lace would be altogether untouched, and the *filaments* not *burnt at all*; so, like everything else, it is confined to a certain limited range of action, and if this limited range is exceeded in any case, either by too great or too slow a velocity, the desired effects are *not* produced; but since the invention of gas, and the admirable improvements it has undergone, this has been introduced, and used instead of the red hot cylinder, the net-work is now passed at a great velocity through a flame of gas, and this is found to answer much better than the hot cylinder. This case, like the former, is limited; it may be either too slow or too rapid, to produce the desired effects. Another example of time may be advanced in the bursting of a gun; if in loading a gun the wadding does not touch the powder, there is always more or less a liability to burst; suppose that instead of lying closely on the powder, it remains near the mouth, or in the middle of the gun, then, when the gun is discharged, it will require time for the expansive agency of the explosion to reach the wadding, and this time may probably be greater than the time necessary for the effect of the explosion to shatter the barrel; if this is the case, the gun will invariably be shattered, but if the barrel is so strong as to require a greater time of action, the gun will not burst; and the same may be said in firing a candle through a deal board; if it requires a greater time for the explosive projectile force to break the board than it does to break the candle, the latter will not be broken, but actually pass through the board, and *vice versa*. Upon the same principle of time, the Doctor proceeded to explain the theory of the bursting of steam boilers. Boilers have burst when

Digitized by Google

the steam-valve has been open, because it required a less time for the action of the force to burst the boiler, than to force itself through the safety valve aperture. If the time of bursting the boiler had been equal to the time necessary for forcing itself through the aperture, the boiler would not have been burst, but only strained; if, again, the time of forcing itself through the aperture had been less than the time necessary to burst the boiler, no explosion could have taken place, for the steam would have had sufficient time to escape, so that these things are entirely a *matter of time.*

The lecturer also advanced the following experiment as illustrative of the necessity of allowing time for all things, of course more particularly alluding to the effects produced by mechanical agents. Whatever the agents may be, and howsoever the power may be applied, for it must be obvious that every effect is produced by the action of a corresponding cause, and that this cause could not produce its effects without allowing, we may say, for the concentration of the cause that produces the effect: he said, that being in Scotland in company with a Mr. Russel, who is well known to the scientific world by his Reports to the British Association on canal navigation, they were performing an experiment to ascertain whether it was possible to increase the ordinary rate of travelling on canals from four to twelve or fourteen miles, and also to judge of the action of the water on the boat during the experiment; for this purpose a light boat was made of iron plates, attached to transverse ribs; so light were the materials made, that they were obliged to remain still on the seats, lest they should break through. In the middle of the boat a round hole was made, and a glass tube inserted; and, as a matter of course, by the law of statics, the water rose when the boat was at rest to the same altitude in the glass as it stood on the outside of the boat; a rope was now attached to the boat, and the boat drawn by a swift horse; at first they observed but very little variation in the altitude of the water in the glass tube, but as the horse gained his speed, it was distinctly plain that the water was falling, and this with more rapidity, till at length the horse got to the rate of sixteen miles per hour, when the water *entirely disappeared* from the tube! What, then, is the conclusion at which they or anyone else would arrive at? Certainly that the boat was *not* in the water *at all*, but actually gliding on its surface like a skater on the surface of ice. Now this fact must be undoubted, for, by statical laws, water will always find its level, and, consequently by this, the water in the tube would be an exact gauge, not of the velocity, but of the depth to which the boat had sunk in the water. The lecturer then proceeded to show that this was entirely a matter of time, like all the rest. Now, said he, when the boat was at rest, it sunk the deepest, because then, it had sufficient time to sink; but when any motion was given to the boat, part of this time was diminished, and consequently, at every successive step, it has less time to sink. He then said, that if the boat could pass over its whole length in two seconds it would sink but so much; but if it could pass over its own length in one second, it would then not sink so much by one-half; if it could pass over its whole length in one-fifth or one-tenth of a second, it would then only sink one-fifth or one-tenth of the first depth. He therefore arrived at the conclusion that the boat had not time to sink, and that when it was at its highest velocity it did not sink at all, but glided on the surface; and at the same time that the velocity of the boat increased, as a matter of course, according to the above, the resistance must diminish, perhaps in the same ratio. That this is the case is readily proved, first by the elasticity of the rope, by which the horse drew the boat; for, manifestly, when the resistance is the greatest, the force of traction to overcome this resistance must be the greatest; and thence, between these, when the pull is the hardest, the rope will be most strained, and therefore the tightest. Secondly, it is well known that the greater the velocity of a horse, the less his force of traction; for that power which at a slow rate was employed in propelling the boat, is now employed at a greater rate in propelling himself, and maintaining his velocity.

*( To be continued.)*

*Ancient Eclipse.*—An account was lately read at the Royal Astronomical Society of some computations agreeing with the time of an eclipse of the sun observed in China, Oct. 13, no less than 2,128 years before Christ, or nearly 4,000 years since. The time of the greatest obscuration has been computed by Mr. Rothman to be from the solar tables of Delambre and the lunar elements of Damoiseau, to have happened at 8′ 47″ past noon, with 10¼ digits eclipsed, according entirely with the indications of the Chinese chronicles. For not predicting this eclipse, the two astronomers, Ho and Hi, were put to death.

Digitized by Google

# THE CHEMIST.

## MODE OF COLLECTING GASES THAT ARE ABSORBED.

(See Figs. I. II. front page.)

THE following is the mode of collecting gases that are absorbable by water, without the aid of a mercurial trough:—As the use of a mercurial trough is both inconvenient and expensive, there is an easy mode of preparing gases without having recourse to any trough, merely by the displacement of the air of the vessels in which they are to be collected, provided they are not very noxious. Fig. 1, A, the retort containing the mixtures for preparing the gas, has a bent tube B, adapted to it with a bulb at C, to collect any moisture that may be condensed. The tube passed through the mouth of the bottle D, is made to terminate near the bottom. If the gas be heavier than air, the mouth of the bottle must be kept up as represented in Fig. 1, so that as it escapes at the bottom, it may gradually push out the lighter air above it. If lighter, the apparatus must be adjusted as Fig. 2, with the mouth of the bottle below, so that the gas may force down the heavier air. In this way, by carrying on the process for some time, though a good deal of the gas escapes, yet the receiver may be very nearly filled with it, and it is sufficiently pure for many purposes, as for merely showing the general properties.

J. R. WATTS, M.D.

## IMPROVED APPARATUS FOR PASSING GASES THROUGH LIQUIDS.

(See Fig. III. front page.)

*To the Editor of the Penny Mechanic.*

SIR,—I have just completed an excellent little apparatus for passing sulphuretted hydrogen, or any other gas, through a liquid, a sketch of which accompanies this communication, which I trust will not be deemed unworthy insertion in your widely circulated magazine.

In the engraving A A, represents a bottle containing the liquid to be impregnated with gas. A large cork fits tight in the neck of it, and is mounted with a brass cap, B B. On this cap a brass plate, C C, is fitted air tight, and is moveable on the centre pin, D. The plate, C C, the cap, B B, and the cork to which they are fixed, have corresponding holes, E F, E G, drilled through them at equal distances from the centre.

F F, is a glass tube, inserted in the lower part of the cork, and is long enough to reach within a short distance of the bottom of the bottle. The plate, C C, has two short metal tubes, E F, cemented in the holes drilled through it. To one of these tubes a bladder, containing the gas, is attached by the stop-cock, H, and to the other tube an empty bladder must be neatly affixed with packthread.

To use the apparatus, open the stock-cock, H; and, on pressing the bladder, the gas will escape through the glass tube, F; and, whatever is not absorbed, ascending through the liquid, will enter the empty bladder, I, at G.

The plate, C C, being moveable on the pivot, D, the opening of the bladder, I, which becomes inflated, must be brought over the glass tube, F, by turning the plate half round. The bladder which before contained the gas will now be over G; and, on pressing the bladder, I, the gas will descend as before, through G, so that by alternately altering the position of the bladders, by means of the plate, C C, always keeping the flaccid bladder over G, and the inflated one over the tube F, the operation may be continued so long as the bladder contains any gas. Only one of the bladders requires a stop-cock for the convenience of removing it from a gasometer.

To avoid the inconvenience of pressing the bladders with the hands, it would be very easy to contrive boards to press them, as in Gurney's oxy-hydrogen blowpipe, a weight to supply the place of the hand. The cost of such an apparatus would be from eight to ten shillings: mine cost eight shillings and sixpence.

I am, Sir, yours, &c.

Brighton, Jan. 25th, J. GORDRED.

## REGISTER THERMOMETERS.

(See Fig. IV. front page)

DIFFERENT methods have been recommended for ascertaining the highest or lowest temperature that may occur at any particular period, as during the night, when there is no one present to observe it. The simplest contrivance of this kind is that of Dr. Rutherford, of Kinross: it consists of two thermometers, a spirit one, H, and a mercurial one, B; the former for ascertaining the lowest, and the latter the highest heat. Into the tube of the former is placed a small piece of white enamel, which, as the fluid contracts, is brought along with it, suppose to 30, but in its expanding is not taken with it; it is left at the place it was carried, and thus the lowest temperature that had happened is pointed out. Into the tube of the latter is placed a small piece of a needle, so as just to rest on the mercury. As the fluid expands, it pushes the needle before it, and

Digitized by Google

on again contracting, it leaves it at that part to which it had carried it, so that in this way the highest temperature is ascertained. These thermometers are fixed on a board, with the bolts at opposite sides, the mercurial one horizontally, the spirit one with the ball inclined downwards, so that when we wish to set them, by raising the side next the spirit ball, the enamel and needle will come to the surface of the fluids. J. R. WATTS, M.D.

*To the Editor of the Penny Mechanic.*

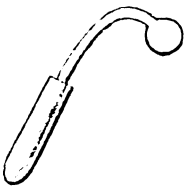
SIR,—I have not yet given a description of the following salt, which is new to all the chemists I am acquainted with. I first observed it deposited in great abundance in Mullin's modification of Daniell's battery, after a great quantity of sulphate of copper had been decomposed. To those of your readers who are not acquainted with the construction of Mullin's battery, the following description may not be unacceptable. A cylinder of zinc is formed of the size, say of a pound pot, into which it fits; a copper cylinder is to be made so much smaller, that when a bladder is tied round the cylinder, and filled with a solution of sulphate of copper, it may be put in and taken out with ease and facility. Into the pot containing the zinc, a solution of muriate of ammonia is to be poured, so that when the copper vessel is immersed, the fluid will stand nearly on a level with the urn. The battery is now in action, and will remain so till all the sulphate of copper becomes decomposed. Two wires are soldered, of course, on the two cylinders, and polar connection made as usual. When this battery has been in good action for some hours, crystals of the new salt make their appearance, and form very rapidly. They are composed of sulphuric acid, ammonia, zinc, and copper. They contain not the slightest trace of muriatic acid, and the solution in which they form, I have generally found to contain in great abundance a double sulphate of zinc and ammonia. The salt, of course, is a sulphate of copper, zinc, and ammonia, and for the portion of copper it contains, it has a very colourless appearance, being very similar to pure proto-sulphate of iron. I have not yet determined its exact composition, but shall send you a description when I have done so. I am prosecuting some new facts, which have made their appearance in connection with the above, and shall be able soon to send the particulars.

I am, Sir, yours, &c.

J. C. COOMBE.

P.S. I may here observe, in answer to C. Parke, that iodine is found in sea water, as well as in many mineral and salt springs; likewise that it is found in the mineral world in combination with silver. Vauquelin and Turner are my authorities.

*A Director for passing the Electric Shock in any particular direction.*—This may be made by fixing into a test tube, or glass rod, a brass wire, curved at the extremity, and terminated in a ball; when used, a chair or wire is fixed on it, and connected with the Leyden jar. ELECTRON.



*Native Oil of Laurel.*—In the Quarterly Journal of Science, No. 35, an account is given of a volatile oil obtained from a tree of the laurineæ family, which abounds in the fertile regions between the Orinoco and the Panine, in America. It is procured by striking into the tree with an axe, and as it is not distributed equally in every part, some skill is necessary to find out the proper spot. The native oil resembles the essential oil obtained by art in many of its properties, but is purer. It is very volatile, and very little heavier than alcohol. Its elaboration in the plant is a curious fact, and may lead to some interesting researches and discoveries in vegetable physiology.

*Preserving Stuffed Birds.*—The best means of saving stuffed birds and quadrupeds from the attacks of minute insects, is by placing a small wooden basin, containing tallow, in each case, which will be found more effectual than either camphor or Russia leather.

*Club Moss (lycopodium lavatum).*—Its seeds are combustible and explosive, and are used in theatres to make lightning. They consist of a fixed oil, sugar, and mucilage.

*Clyssus.*—A name given by the alchymists to the water or vapour which they obtained by detonating nitre with charcoal or phosphorus, and to which they ascribed a great many virtues.

*Chromium.*—An undecomposed metal, so named from giving a red colour to other bodies. It was first detected in 1797.

Digitized by Google

# INSTITUTIONS.

LECTURES DURING THE WEEK, ETC.

*The Meteorological Society*, Mechanics' Institution, Southampton Buildings, Holborn.—Meetings will take place on Tuesday evenings at the following periods:—April 10, May 8, June 12.

*Tower-street Mutual Instruction Society*, 16, Great Tower-street.—March 5, Mr. Coupland, on Life and Fire Insurances.

*Southwark Literary Society*.—March 7, T. J. Serle, Esq., on Shakspearian Readings.

*St. Pancras Literary and Scientific Institution*, Colosseum House, New Road.—Friday, March 2, Dr. Walker, on Comparative Anatomy.

*Hall of Science*, Commercial Place, City Road.—Monday Evening, at half-past eight, J. C. Coombe, on Chemistry.

## QUERIES.

*To the Editor of thePenny Mechanic.*

Sir,—Having read, that for the Ventilation of Cotton Factories an apparatus is used, by which any amount of vitiated air may be drawn off without admitting the external atmosphere, I should feel obliged if any of your readers would furnish me with a description of one which would answer the purpose for a common apartment. Rotary fans, pumps, &c., worked by a weight, have been suggested.

Feb. 15. A B.

Sir,—I should feel much obliged by your giving insertion to the following queries:—1st, What is the best form for the Sails of Windmills, their proper obliquity, or angle, with the plane of motion?—2nd, What is the proper method of setting out Cog Wheels, with the best form of their teeth, particularly crown and bevil gear?—3rd, Whether the most advantageous mode of increasing velocity by a series of wheels, is to adjust them so that the multiplication of velocity shall proceed in aritkmetical or geometrical progression? R. W. Lane.

Sir,—I should feel greatly obliged if any of the Readers of your valuable little Magazine would inform me how to Soften Quills, so as to enable me to change their form, and afterwards harden them again.

F. V. E.

## ANSWERS TO QUERIES.

Sir,—For the information of your Correspondent "C. C. W." I subjoin the following experiment with phosphorus. If a small portion be dropped into a Florence flask, nearly filled with water, and a sufficient heat be produced to raise the temperature of the water to the boiling point, balls of fire will be seen to ascend towards the top of the flask. This experiment proves the extreme inflammability of the substance. It also proves the fact, that phosphorus has a slow combustion at common temperature, and consequently always appears luminous in the dark. As it is frequently used by youths for the sake of sport, it may be necessary to caution them to take great care, or the most disastrous effects may follow.

Jean E***g.

"T. G. O."—*How to make Cheap Electrical Apparatus*. See Penny Mechanic, Nos. 37, 48, 69.

*To make a Galvanic Pile*, see No. 42.

*To make Plate Powder*.—Sir, in No 68 of your Periodical, "A Subscriber" wishes to know how to make Plate Powder. The following he can obtain at a very cheap rate, and will find very generally useful for cleaning plate, &c. Mix 1 oz. of mercury and chalk (which can be obtained at any chemist's shop), and 7 oz. of very best prepared chalk, together, and colour, if required, with some rose pink.—R. L. H.

Sir,—In answer to "O. P. Q." No. 69, I would observe, if he had divided the whole cost of the several lots of goods by the aggregate weight, he would have obtained the average price. By reducing the cost to pence, and the weight to pounds, the process is very simple. His plan appears to work right when either the weights or the prices of the several lots are equal.

Philo.

Sir,—I beg leave to inform "J. E." that the hands being frequently moistened with diluted sulphuric acid, will be enabled to resist heat.

The following are answers to "J. D.'s" queries:—1st, Mercury, dissolved in nitric acid, will form Nitrate of Mercury.—3rd, Sulphate of Copper is made by dissolving copper turnings or pieces of wire in boiling sulphuric acid.—4th, Cylinders of Zinc, Brass, or Lead, may be cast in moulds of loam or clay made dry? H. L. N.

## TO CORRESPONDENTS.

*We thank* H. L. N. *for the Answers he has sent us. He will see the first has been described by our friend*, Dr. Watts.

*The Experimental Brick Beam, erected by Messrs. Francis and Son, shall be noticed in our next*

*We shall feel most happy in giving insertion to the paper of* Vanderkiste, jun., *on Firing, if found to be of general interest, but Poetry we invariably refuse; we hope, therefore, he will not feel offended at our rejecting his.*

R. Hatch, of Yarmouth, *is informed that the Lord Mayor, a short time ago, suggested the plan of a rope being always kept ready in the bed-room, in case of fire, which is to be used exactly in the way recommended by our Correspondent.*

A. J. B. N.—*The public will not be made acquainted with the full particulars of the principle of the Tubus Calefactus until the patent is sealed.—We thank him for his kind offer; the subjects, no doubt, will be edifying.*

T. G. O. *is informed that an apparatus for Clearing Rails on Railways, similar to that proposed by him, has been in use some time. It was patented by Mr. Hawthorn.*

Dr. Watts's *communication has been received, for which we thank him. He will see we have inserted some of the papers he refers to.*

T. Mathews. *The definition in that part of the article he refers to was given in too wide a sense. It was meant that the apparatus might be exhibited (similar to the way in which the Tubus Calefactus has been for some time), where it could be done without disclosing the secret of the invention.—To the latter part of his letter we can only say, make strict enquiry into the character of the person, and then get the agreement signed, before he be allowed to see the model, or any explanation takes place.*

*The letter left at our office, by Mr. Thomas, directed for* Mr. Mathews, *has been returned by the latter. It ought to have been addressed to* T. E. M., *the Correspondent whose request appeared in No. 68.*

Philo's *answer to the Wheel-and-Pulley question has has been received.*

Tyro Lock *has our best thanks for the interesting Lecture he has sent us, which was delivered at the Mechanics' Institution by the highly-gifted Dr. Lardner.*

A Subscriber. *We have answered the same question before. Cheap pleasure excursions on Railways, for working men, will, we are sorry to say, be the last consideration.*

Received, Formator—C. D. Thomas.—L. Glaucus—B. Rixton, &c.

Errata.—In Nos. 70 and 71, page 242, line 16 from bottom, for "opposing opposition," &c., read, *opposing—opposition I do not, &c.*—line 14 from bottom, for "not least opaque," read *least opaque*—page 246, line 5 from bottom, for "emptive," read *eruptive*.

London: Printed at the Holloway Press, by D. A. Doudney; where all Communications are to be addressed (post paid); published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

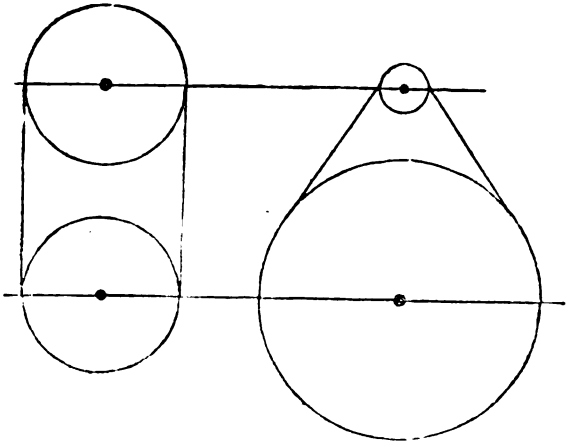
Digitized by Google

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. LXXIII.] SATURDAY, MARCH 10, 1838. [Vol. II.

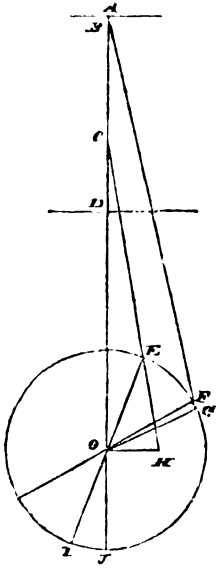

### WHEEL AND PULLEY.

FIG. I. FIG. II.



### THE CRANK.

FIG. III.



### WATER ALARUM.

FIG. IV.

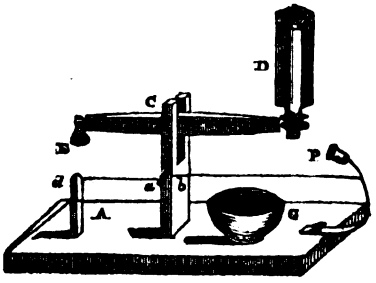
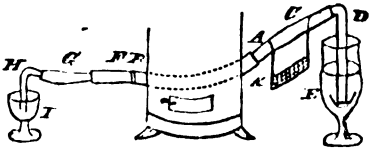


FIG. V.

### POTASSIUM APPARATUS.




Vol. II.—No. LXXIII. Holloway Press: D. A. Doudney.



Digitized by Google

## THE WHEEL AND PULLEY.

(See Figs. I. and II. front page.)

*To the Editor of the Penny Mechanic.*

SIR,—I wish to make a few remarks upon the *wheel* and *pulley* question of "J. S. H." in your 65th Number, which I find incorrectly answered by "F. T. G." in No. 68. The object sought, is a rule for finding the diameters of the grooves in a wheel, when the diameters of the grooves in the pulley and one of the grooves in the wheel are given. In this case the diameters of the grooves in the pulley are 3, 4½, and 6 inches, and the groove in the wheel 24 inches. The diameters of two other grooves in the wheel are required, so that one band may serve for the three different motions. "J. T. G.'s" answer is, "supposing the 24-inch groove to correspond with the 3-inch pulley, that a 22½-inch groove will be required for the 4½-inch, and a 21-inch for the 6-inch pulley; that in proportion as the diameters of the pulley are increased, so the diameter of the corresponding wheel must be decreased;" and he adds, "the distance of centres is immaterial."

If "J. T. G." had studied this subject either in *theory* or *practice*, he would have known that neither of his conclusions are correct. It will be observed, that the sum of the diameters of each pair of grooves amount to 27 inches; and upon this principle, if there had been a groove in the pulley of 13½ inches, a corresponding groove of 13½ inches would be required in the wheel. Let us examine this principle by a diagram. Fig. 1 represents a wheel and pulley, whose diameters are each equal to 13½ inches, and Fig. 2, a wheel of 24 inches, with a pulley of three inches. The centres of each pair being at equal distances. It will be seen at a glance, that the band of Fig. 1 is shorter than that of Fig 2. Those parts of the bands above and below the centres will be equal in each case, excepting that the band, diverging from the small pulley before it reaches the centre, makes it a little longer.

In examining those parts of the bands between the centres, we find those of Fig. 1, being parallel to each other, must necessarily be shorter than the corresponding parts of Fig. 2, which are oblique, and the nearer the centres are brought together, the greater will this difference be. On the contrary, the further the centres are removed from each other, the nearer equal will the lengths of the two bands become. I have adopted an extreme case for illustration, but the same reasoning will hold good for every variation of diameters.

I am not aware that any rule can be given which will meet the case properly, but a general knowledge of *geometry* and *arithmetic*, will enable us to come very near the truth, so that a little adjustment is all that would be required when the machine is put together. The dimensions of each groove may then be taken, and gauges made for future use.

From this examination of the subject, we arrive at the following conclusions:—1st. That the greater the difference between the diameter of the wheel and that of the corresponding pulley, the less must the sum of their diameters be; 2nd. That after all the diameters have been properly adjusted, any alteration of the distance of centres will make another adjustment necessary. PHILO.

## ON THE CRANK.

(See FIGS. III. Front Page.)

*To the Editor of the Penny Mechanic.*

SIR,—If the following few hints are of any service to your Correspondent "T. M.," in helping him to solve the difficulty he mentions, they are at his service. When the steam gives motion to the piston, the connecting rod of the crank transfers this motion to the crank, which is driven round, so that the extreme end of the crank describes a circle, the length of the rod vibrates angularly up and down in a space equal to the length of the stroke of the engine. As in the figure, with the length of the crank as radius, describe a circle; draw and produce perpendicularly the diameter J. D. A., and upon this line take the whole length of the connecting rod, from the top of this mark of the length of stroke, as A D, then evidently the connecting rod vibrates up and down in this length; and to make this correspond with the present question, assume the lengths, &c. to be equal to unity, divide A D into 100 equal parts, and take 5 of them, as A B, then with the whole length of connecting rod and centre B, describe a circular arc cutting the great crank circle in E; join B E, and it is the direction at which the power acts on the crank E I, then from the centre O erect a perpendicular to the direction of the power, and O H is by mechanics the effective leverage; this construction agrees with column,

A B C D

·05, 1512, 46, 128.

And proceed just the same way to find any others; thus for instance, take ·5, then bisect A D in C, take C as a centre with length of crank; draw a circular arc cutting crank circle in G; join C C, draw the per-

Digitized by Google

pendicular O F to the *direction* of the *power* with crank, then O F is the effective leverage, which as in the column is equal to the radius; then if the angles are measured by a proper instrument, and the lengths by the scale, we shall find the values the same as in the table; but the question is to find the effective leverage by computation, and thence to find the total power of the crank, this I will defer for another paper, and as soon as time will permit it shall appear.

TYRO LOCK.

## WATER ALARUM.

(See Fig. IV. front page)

*To the Editor of the* PENNY MECHANIC.

SIR,—Having some time since made a Water Alarum, I was solicited by a young friend to explain the construction of it, and I promised to send him a drawing with a description; but recollecting that he was (like myself) a subscriber to your useful publication, and thinking it might be of utility to others, I have sent the enclosed for insertion if you think fit.

The plan is both simple and economical, and I shall only say in recommendation, "Probatum est."

I have found water succeed better than sand, as sand is very liable to be affected by the change of atmosphere.

EXPLANATION.—The drawing represents the Alarum when set. A, is a deal board, 18 inches long by 6 wide; B, an upright 12 inches high, firmly fixed about the middle of the board, having a balance-beam, C; D, is a vial (which must be perforated at the bottom) in an inverted position, having a cork, in which is inserted a brass tube of a very small bore (so small that the water will drop slowly); E, is a weight, which when the phial is empty will just preponderate; F, is a bell and spring, fixed as above; G, a vessel to receive the water from the vial; *a*, is a small piece of watch-spring; *b*, a small brass peg, both inserted into the edge of the upright B, and projecting horizontally side by side; *c*, is a small pin with a flat head (a tin-tack will do very well) fastened to a string, the other end being attached to the spring of the bell, the string must be of sufficient length to confine the bell in the position shown above; *d*, is a small upright, to which a thread is fastened, the other end being tied to the watch-spring, which will keep the thread in a state of tension. So much for theory, now for practice.

Fill the vial with water (it should be filtered), and having noted the time, make a mark on the vial at the height of the water on the expiration of every hour: the vial will now be graduated. Now, to set the Alarum, nothing more is necessary than to place the tack with the head downwards between the watch-spring and peg, and to pour water into the vial according to the required time, when the whole of the water has dropped out, the weight will descend upon the thread beneath, which will pull the watch-spring and liberate the bell. I remain, &c.,

H. WELLS.

## LECTURE
### ON
## MECHANICAL AGENTS.

BY DR. LARDNER.

*(Concluded from page 251.)*

But from this experiment we must not conclude, that canal boats, drawn by horse power, can ever practically attain this speed; for there will be many causes to interfere with their velocity, which could not happen in the case of the experiment, both in regard to the depth of the water-line, and construction of the boats.

The lecturer now proceeded to the most important application of heat to the practical arts, and from which application the greatest and most available power was to be obtained, merely by the evaporation and conversion of water by heat to steam. Suppose we have a long glass tube conveniently fixed for our purposes, of an inch area, and of any length; let there be a quantity of water at the bottom of the tube, just one inch high, consequently there will just be a cubic inch of water; and let there now be added to the tube a thermometer, so attached to the lower part that it shall be able to register every variation of temperature that takes place in the water upon the application of a spirit lamp; and further, let the tube be accurately adjusted with a perfectly air-tight piston, which is so fitted as to admit of motion, and finally to be loaded with a weight of 15lbs. If now the heat of a lamp be applied to the bottom of the tube, it will soon be perceived that the thermometer begins to rise, and after a few minutes the index will be rapidly travelling towards 212° degrees of Farenheit in our latitudes, and when the thermometer arrives at this point it will be seen that the piston has also now begun to rise; if the heat is continued, or even increased, we do not find that the thermometer rises, but, on the contrary, persists in remaining at 212°.; but the piston begins to ascend more and more rapidly, till at length it reaches an eleva-

Digitized by Google

tion of about 140 feet, where it now begins to remain stationary. If the lamp be at this time removed from the tube, the following phenomena takes place:—At first a slight vapour appears, and soon afterwards a few small globules of water, at the upper part of the interior surface of the tube, which gradually, but quickly, accumulate, and trickle down the side of the tube; till at length the whole of the cubic inch of water that had disappeared, on the application of the lamp, returns, and will be found at the bottom of the tube, undiminished in quantity; and it would be observed, that as the water accumulated more and more at the bottom of the tube, so would the piston descend, and finally be found in the original position. If the lamp was to be applied again the same effect would be again observed; and it is almost needless to state that this alternate evaporation and condensation is the principle upon which the steam-engine acts.

We have already stated that the piston was raised by the expansive force of the evaporated water to a height of 140 feet, and the piston itself weighed 15 pounds; whence, by mechanics, the effect produced by the evaporated water, would be equivalent to 15 pounds raised 140 feet high; or, which is the same thing, equivalent to $15 \times 140 = 2100$ lbs. raised one foot high. This then is the force we can obtain by evaporating one cubic inch of water into an aeriform fluid—steam. Now it can be experimentally shown, that if any weight be raised to a given height, by the descent of the same weight it will raise another weight equal to itself; and, consequently, if we, by evaporating water, can raise any weight, we can, by condensing the evaporated fluid, and the descent of the raised weight, raise another weight equal to it; so that it is equally effective upwards or downwards, by expansion or by condensation; thus exhibiting in a clear light the almost unlimited range of heat, and the gigantic power it gives in the hands of man, in the modified form of the steam-engine.

But although, in the tube above, one cubic inch was capable of raising nearly a ton weight one foot, it must not be expected that such a result can be obtained practically, from waste of steam, friction, and other causes. If a steam-engine produces but half this effect it works well.

TYRO LOCK.

— —

## PADDLE-WHEELS.

*To the Editor of the* PENNY MECHANIC.

SIR, — Having invented a paddle-wheel which is novel in its construction, and far superior in simplicity and utility to any yet produced, I am desirous to give it publicity through the medum of your widely-circulated Magazine, in the hope to obtain an assistant or assistants to join with me in bringing it into use, and to partake in the benefit that may arise from its adoption.

I have watched the progress of improvement in the Paddle-wheel for the last thirteen or fourteen years, and find, that although it is one of the most important members of marine machinery, it is at the same time one of the most defective. In all the improvements hitherto introduced, a sameness exists in their construction, with only one exception of little or no importance, and that is, what is called "Galloway's Patent," the paddle-board of which is formed after the principal of the venetian blind. The principal of action consists of a revolving motion in the paddle-board on a vertical or horizontal axis, composed of cranks, wheels, pinions, and eccentrics, subject to great friction and heavy straining and fracture, which exhausts as much steam power, or *consumption of fuel*, with as little effect as the original common fixed paddle-wheel, with all its defects, encountering under all the circumstances of the superficial "dip," &c., the front concussion, and the back-water lift; and, that when the vessel is rolling in a heavy sea, one wheel is raised wholly out of the water, and the other is wholly submerged, each by its fan-like principal encountering resistance of wind and water round the entire circumference, producing a zig zag course instead of a straight one.

Some few years ago an eminent engineer attempted to use the paddle-wheel in the centre of the vessel, but failed; the cavity running through the centre of the vessel proving insufficient for the discharge of the back-water. And the paddle-wheels working in the air-tight cavity, the fans or paddle-boards met with such resistance from the air collected above the water, that blowing cylinders were applied to the top of the wheel to assist them round, and force out the air.

My object in overcoming the difficulties and waste of steam power at present encountered in steam navigation, as far as the paddle-wheel is concerned, and partly enumerated above is fully obtained. Its superiority is, that the submerged propelling paddles rest square and solid on the

Digitized by Google

frame of the wheel, as though bolted down; consequently all friction and straining is effectually done away with when at work, and the whole of the steam power is brought to bear upon the vessel's way. The paddles having done their work, are perfectly neutral; and the wheel will propel with equal effect either wholly submerged in an air-tight paddle-box, or in the centre of the vessel; which I conceive is important to steam ships of war, and canal navigation.

Your obedient servant
*Feb.* 25th. T. MATHEWS.

## ON THE NATURE AND PROPERTIES OF STEAM.

NO. VI.

VIS VAPORIS.

THE most improved and generally-used form of the low-pressure engine, is Watt's double-acting engine. In this the moving power operates upon a piston moving in a cylinder, closed top and bottom, in which the piston moves air and steam-tight. The piston rod is connected with the end of the beam, and works through an air-tight *stuffing-box* in the cylinder top. When this machine is first set to work the atmospheric air is expelled from the cylinder and the pipes, &c. by the admission of steam from the boiler, and there is a valve provided for its escape. When all the atmospheric air, &c. is expelled, the engine is then filled, of course with steam. Adjoining the cylinder is a chamber called the condenser, immersed in cold water, and thus kept at a low degree of temperature, and between this chamber and the cylinder, is a communication provided with the necessary valves, &c. When the piston is required to ascend, the communication between the condenser and top of the cylinder is opened, and the steam which this contained rushes, by its elasticity, to the condenser, and is there condensed by the action of a jet of water which flows into the condenser; steam from the boiler, at the same time enters the bottom of the cylinder, which forces the piston up, the other side being an imperfect vacuum caused by the partial condensation above mentioned; when the piston has reached the cylinder top, the condenser is made then to communicate with the bottom of the cylinder. A vacuum is hereby formed in the bottom of the cylinder, and the steam from the boiler entering now at the *top*, drives the piston downwards, and thus the alternate motion is continued so long as the steam is allowed to issue from the boiler. The working beam has by this means a see-saw motion communicated to it by the piston rod; and at the other end of the beam, there is a *connecting* rod by which this motion is applied to turn a crank, and thus a rotary motion is produced. The alteration of the valves, &c., is effected by simple machinery worked by the engine itself, which also works from rods connected with the beam. The air pump clears the condenser of the condensation water, injection water, and also any air that may by any means enter; there is also an hot-water pump which supplies the boiler with the warm water, drawn by the air-pump from the condenser, and a cold-water pump to supply the cistern and condenser. In pumping-engines the crank is not applied, the pump-rod is directly fixed to the opposite end of the beam to that of the piston rod.

C. D. T.

## STEERING BALLOONS.

*To the Editor of the Penny Mechanic.*

SIR,—In No. 70, I find a proposition for steering balloons, which your Correspondent calls a "new method;" his *machinery* is both new and complicated; but this is the only novelty. Our countryman Blanchard attempted to steer by paddles or oars, and before his day, Roberts and Colen Hullin, in conjunction, had done the same; the first named did not perceive that he produced any sensible effect upon the course of his balloon; the latter stated, as well as I remember, that they had caused theirs to deviate from the direction of the wind about 22 degrees. In the spring of last year, Sir George Cayley published a plan for steering balloons, displaying great ability and research, wherein he proposed to effect his object by revolving sails. To the above facts, which are of public notoriety, I may add, that more than two years since I invented and submitted to several gentlemen well known in the scientific world, a machine somewhat similar in principleto that of Sir G. Cayley, but more perfect in its action, by means of which the ocean of air can be navigated with as much certainty as the ocean of water, and probably with much fewer contingencies. I am, Sir, your obedient servant, A PICKWORTH.

*Falling Stars.*—Mr. Herrick, of New Haven, has computed that three millions of what are called shooting or falling stars, penetrate the atmosphere daily.

Digitized by Google

# THE CHEMIST.

## ELECTRICITY.

*To the Editor of the* PENNY MECHANIC.

SIR,—According to the wish of your Correspondent respecting the electricity of a cat's back, I send the following:—

It is well known that an electric shock is caused by bringing the positive and negative surfaces of a leyden jar in contact, and by overcharging one and making a communication with the other, to restore its equilibrium, a shock is the consequence. In a leyden jar, the thinner the glass, the more sudden and more strong the shock.

The grand basis of electricity is laid upon the attractive or negative, and the repelling or positive powers; also the electric or non-conductive, and the non-electric or conductive powers. Everything has a certain portion of electricity, and if overcharged beyond its natural quantity, it will discharge its overplus upon the nearest attractive substance, not having a like proportion of electricity. Such is the theory of thunder clouds; the lightning, a discharge of electricity from an overcharged cloud; the thunder, the noise occasioned by such discharge. Electricity is always excited by friction: rub any two substances together, not having the same tendency, they will be charged with electricity in an excited state. If a black and white ribbon be rubbed together, the former will be found to acquire resinous, and the latter vitreous electricity; therefore, if we rub a living cat's back, electricity is produced. If we rub with the right hand, the positive point, and place the left hand under the animal's throat, the negative point, the hair being an electric substance, and therefore non-conductive, is capable of being overcharged, and the communication being made between the right hand and the left, a shock is felt in restoring the equilibrium, and *vice versa*.

The following is a list of substances which acquire vitreous electricity when rubbed with any of those which follow in the order they are set down, and resinous, if rubbed with any of those which proceed:—

1. The back of a living cat.
2. Polished glass.
3. Woollen cloth.
4. Feathers.
5. Wood.
6. Paper.
7. Silk.
8. Gum-lac.
9. Brightened glass.

The following is a list of conductive or non-electric substances, the first being the greater and the last the lesser conductor, going in rotation from beginning to end, according to their conductive powers:—

1. The perfect, or least oxidable metals.
2. The more oxidable metals.
3. Charcoal, prepared from hard wood, and well burned.
4. The concentrated mineral acids.
5. Plumbago.
6. Diluted acids.
7. Powdered charcoal.
8. Solution of metallic and neutral salts.
9. Metallic ores.
10. Animal fluids.
11. Snow,
12. Pure water.
13. Living animals.
14. Living vegetables.
15. Steam.
16. Flame.
17. Smoke.
18. Metallic salts.
19. Rarified air.
20. Salts with alkaline or earthy bases.
21. Vapour of alcohol.
22. Vapour of ether.
23. Earth and stones in their ordinary state.
24. Flower of sulphur.

The following is a catalogue of electrics, or non-conductive substances, beginning with the least, and ending with the greatest electric in rotation:—

1. Dry metallic oxides.
2. Oils.
3. Vegetable ashes.
4. Animal.
5. Dry transparent crystals.
6. Ice below 13° Fahrenheit.
7. Phosphorus.
8. Lime.
9. Dry chalk.
10. Native carbonate of barytes.
11. Lycopodium.
12. Caoutchouc, or Indian rubber.
13. Camphor.
14. Siliceous and argillaceous stones, in proportion to their hardness.
15. Dry marble.
16. Porcelain.
17. Baked wood.
18. Dry atmospheric air and other gases.
19. White sugar.
20. Leather.
21. Dry parchment.
22. Dry paper.
23. Cotton.
24. Feather.
25. Hair, especially that of a living cat.
26. Wool.
27. Dried silk.
28. Bleached silk.
29. Raw silk.
30. Transparent gems.
31. Diamond.
32. Talc.

Digitized by Google

33. Metallic vitrifications.
34. Fat. 35. Wax. 36. Sulphur.
37. Resin and bituminous substances.
38. Amber. 39. Gum-lac.

Hoping this will meet with the same kind attention and consideration with which all my former contributions to your valuable little work has at all times been received, I remain, Sir, yours truly,

Z. WIGO.

## POTASSIUM.

(See Fig. v. front page.)

THE following is the method recommended by Gay Lussac and Thenard for procuring potassium:—Clean shavings of iron are put into an iron tube, A B, previously cooled with clay and sand, or passed through a tube of earthen ware, to protect it from the fire when brought to a white heat, which is done by passing it through a furnace: an iron bottle, C, filled with potassa, is then attached to the aperture A, and having a small bent tube, D, fitted to its upper end, and made to terminate in a glass of mercury, E; to the aperture, B, of the barrel is fixed a copper tube, F, and again to it a copper receiver, G, both of which are to receive the potassium. To the opposite end of G, is attached a bent tube, H, terminating in mercury, I. When the iron shavings are fully heated, a cage of charcoal, K, is placed under C, to fuse the potassa, and make it pass into the tube A B, where, meeting with the iron, there is at first, owing to the decomposition of the water, a disengagement of hydrogen gas, which escapes at I. When this has begun, the chauffer, K, must be removed, and not again applied till the gas nearly ceases to come off. On repeating the process in this way, there is, each time the chauffer is replaced, a disengagement of hydrogen, but at the same time the potassium is also undergoing decomposition, and the potassium, running off in vapour, is condensed in the tubes, F G, which must be kept cool. Should the disengagement of gas at I cease, and gas come out at E, it is owing to the potassium shutting up G; but this is easily removed by holding a chauffer under it, and drawing it over into I. When the operation is finished, and the apparatus sufficiently cooled, the tubes, F G, are to be removed, and naphtha poured through them, after which the potassium may be taken out and instantly placed into a phial with naphtha; if the end of the tube, B, should contain any potassium, it must be plugged up, and when the furnace is cold, it may be got out by first dipping the tube into naphtha, then removing it with a wire.

Potassium has, when recently prepared, the lustre of a metal. It is soft, and can easily be cut, and it then presents the appearance of a piece of newly cut lead. Though resembling metals, it differs from them materially in its specific gravity, being much lighter than water. Gay Lussac and Thenard make it only 895, and Buchatz 870, water being 1000. Its atomic weight, according to Thomson, is 40. It is a good conductor of heat and of electricity. When heated to 70°, it becomes semifluid, and at about 150° it is quite liquid, and cannot then be distinguished from mercury. Though thus easily fused, it requires nearly a red heat for its volatilization, and if the experiment be performed in close vessels, the vapour is condensed unchanged in its qualities. When potassium is exposed to the air, it rapidly acquires a crust on its surface, owing to its uniting with oxygen gas.

The action of potassium and water is remarkable, and presents very striking phenomena. The moment it is touched by it, it takes fire, and burns with a bright red flame. If it be thrown on the surface of a basin of it, it is also kindled, and runs along like a red-hot ball, and there is a slight report when the flame is extinguished. Potassium is even kindled, though the water is frozen; for if a small piece of it be thrown in ice, it is inflamed, and makes a cavity as if the ice were touched by a red-hot wire. In all of these experiments there is a decomposition of the water; the potassium uniting with the oxygen to generate potassa, and setting free the hydrogen, which, escaping in the gaseous state, unites with a little of the potassium, and forms an inflammable compound, which is the cause of the particular appearance of the flame. That there is a decomposition and evolution of the hydrogen, is shown by enclosing a small piece of potassium in wire gauze, and thrusting it, by means of pincers, quickly under water, and holding a funnelled tube over it, a gas rises, which is inflammable, and when exploded with oxygen, generates water. That potassa is formed, can be proved, for if cabbage infusion instead of water be employed, it becomes green, a change by which alkaline bodies are characterized.

These experiments show the necessity of having potassium excluded from air and moisture, and the care that must be taken when experimenting with it, not to allow it to be touched by water. The best means of preserving it, is to keep it in naphtha.

J. R. WATTS, M.D.

Digitized by Google

# INSTITUTIONS.

LECTURES DURING THE WEEK, ETC.

*Tower-street Mutual Instruction Society*, 16, Great Tower-street.—March 12, Mr. Gould, on the Eternity of the World.

*Southwark Literary Society.*—March 14, T. Webster, Esq., on Geology.

*St. Pancras Literary and Scientific Institution*, Colosseum House, New Road.—Tuesday, March 6. Mr. Guthrie, on the Causes and Progress of Civilization.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—I should esteem it a favour if any of your Correspondents would inform me how to make a good black dye for lancewood. W. U.

Sir,—Can any of your Readers inform me of the method of drilling holes in glass and China.

H. L. N.

Sir,—You will favour me by inserting the following queries.—1. which is the best and cheapest method of stereotyping without the aid of the box and boiler, as that is too expensive for an amateur?—2. How is the automaton ship, and sea constructed, such as that at the Adelade Gallery, Strand?—3. Will "Mr. Thomas" favour me with a description of Mr. Hancock's steam-carriage engine?—4. How is the electrical orrery made, which acts by the electricity flying off at points? K. V. CROFTS.

Sir,—A country subscriber would feel greatly obliged to any of your Correspondents, who would in one of the forthcoming Numbers of your Magazine, give a short sketch of the principles of writing as delivered by Mr. Carstair's in his valuable lecture mentioned in Number 65, especially with regard to the method of holding the pen, and whether the effect is to be produced by the action of the fingers and thumb alone, or combined with the motion of the hand. Perhaps "Mr. Wilby," who has already taken the pains to notice the lecture, would take the additional trouble of satisfying Yours, &c.

Cheltenham. INQUIRER.

## ANSWERS TO QUERIES.

Sir,—Seeing an answer to "H. A." in your Correspondents, stating he must carry his velocipede up hill, I beg leave to differ from you in opinion. I have one that will perform up hill at a slow rate; if "H. A." will appoint when and where I can see him it may prove perhaps advantageous to both parties,

W. U. PADDINGTON.

[Our Correspondent does not seem to differ much from us in opinion. He has not stated what amount of labour is expended in ascending an inclined plane at this slow rate.]

Sir,—In answer to your Correspondent "K. I. Y." Nos. 70 and 71, respecting the cheap electric machine, I beg leave to submit the following:—The plate-glass wheel of which he speaks is the most expensive; the wheel costing quite as much as a cylindrical machine can be made for. Say a plate-glass wheel about twelve inches in diameter, with the hole cut in the centre and the edge ground, would cost from 12s. to 15s. A cylinder can be blown of any dimensions, (the larger of course the greater the power), at the Whitefriars Glass-works; as also all the glass-work belonging to a cylindrical machine. A cylinder of about twelve inches in length, and twenty inches in circumference will cost about 4s. 6d, or according to the weight of the glass. GLAUCUS.

Sir,—In answer to your Correspondent "Formator," how to obtain skeletons; the method generally followed is to cut off as much of the flesh as possible, and then to boil the bones in water; but I consider the following process recommended by Hooper in his "Anatomist's Vade-mecum," though tedius, much preferable.—1st. Let the part be put into a pan and covered with water, which is to be changed frequently, until it is no longer coloured with blood; but never after the blood is steeped away.—2nd. Let the macerating pan be placed in a warm place to facilitate putrefaction, for if it be put in a cold place the spermaceti-like conversion of the soft parts will be formed, and the part spoiled.—3rd. The soft parts surrounding the bones are a long time before they detach themselves from the bones.—4th. Bones when macerated should be exposed to the sun's rays, and frequently wetted with clean water, or they may be bleached with the diluted oxyginated muriatic acid.

Bones of the head.—Put the whole head, without disturbing the flesh or brains into the pan. When sufficiently macerated all the soft parts will come away, then detach the vertibræ, and wash out the brain.—P. S. The bones are to be hung together by wire. AN ANATOMIST.

Sir,—I beg to inform "R. W." No. 66, that "A. B. Y. Z.'s" answer to "A Young Mechanic," is incorrect. The seeds should not be soaked in oxymuriatic acid, but in chlorine.

K. V. CROFTS.

*Nitrate of Mercury.*—The metal must be put into its own weight of diluted acid (equal parts acid and water), and the action allowed to go on spontaneously. Should it not commence, a very slight heat may be applied, but removed the moment it begins. The solution is transparent and colourless, very acid and caustic, tinging the skin red. By evaporating and cooling it affords crystals, leaving a solution consisting chiefly of per-nitrate. J. R. WATTS, M. D.

Sir,—I thank you for your kindness in directing me to Warner's, Jewin Cresent, for flexible tubing, but on applying there I was told they did not deal in that article; but for the general information of such of your Readers as may want flexible tubing, I beg leave to state that on my return home, I found the very article I wanted, exposed for sale in the shop of Mr. Woodcock, 177, Strand, who has an assortment of every kind; he is the manufacturer of that, and every other description of articles in India-rubber.

Westminster. I am, &c.

Feb. 19th, 1838. A CONSTANT READER.

## TO CORRESPONDENTS.

A Subscriber *had better pay a visit to the Gallery of Practical Science, Lowther Arcade, Strand, where he will have an opportunity of inspecting vessels which are continually floating about in a pretty little canal formed for the purpose.*

*We suspect our Correspondent*, H. B. W., *is not a subscriber to our Magazine; had he been he might have saved the expense of pen, ink, paper, and postage for the following Query.*—"*Has a Mr. Joyce, of Camberwell, within the last six months, applied for a patent for a new method of burning fuel?*"—*The Tubus Calefactus mentioned in Nos.* 63, 69, *&c.*

W. J. W. *We can see no great objection to cannon being made to unite at the breech, similar to a fowling-piece, provided the gun has a bearing throughout its whole length, to prevent straining at the joint.*

*We have no recollection of the paper on Balloons, which* W. Evans *says he sent us some time ago.*

J. Wilson's *plan for a Water Clock has been received. His queries shall be inserted next week.*

H. Pickworth's *letter on Balloon Navigation shall be inserted.*

*Our notice of the Experimental Brick Beam of* Messrs Francis and Son, *is unavoidably postponed till next week.*

London: Printed at the Holloway Press, by D A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

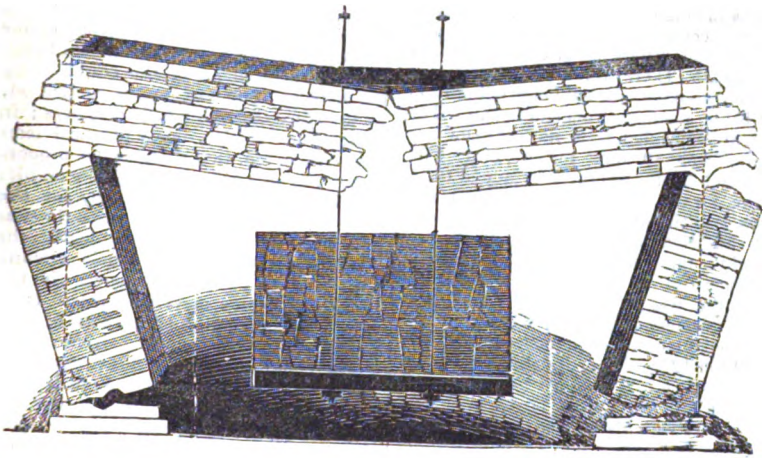
# THE PENNY MECHANIC,

## AND THE CHEMIST.

Nos. LXXIV. & LXXV] MARCH 17, 1838. [PRICE 2*d.*

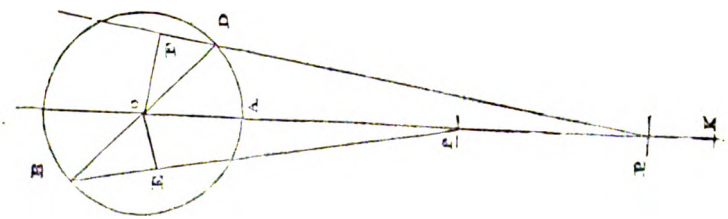
### EXPERIMENTAL BRICK BEAM.

FIG. I.



### THE CRANK.

FIG. II.




VOL. II.—NOS. LXXIV. & LXXV.

Holloway Press: D. A. Doudney.

Digitized by Google

THE

## EXPERIMENTAL BRICK BEAM.

*To the Editor of the Penny Mechanic.*

SIR,—The experimental brick beam erected by Messrs. Francis and Son, cement manufactnrers, at Nine Elms, for the purpose of ascertaining the cohesive power of their cement, was broken down on the 14th ult., in consequence of the ground on which it was built being required by the Southampton Railway Company; and as it may interest some of your readers, I send you the particulars of the fracture from my observation.

The beam consisted of 19 courses of bricks in height, 6 in breadth, and 27 in length, cemented solidly together and raised upon pillars of brickwork, about 5 feet high. There were about eight pieces of iron hooping placed longitudinally in the beam, reaching from end to end. The weight suspended from its centre for two years, was 10 ton, 14 cwt. 1 qr. 4 lb. to which more weight was added till it broke, for the purpose of trying the maximum quantity it would bear previous to any addition being made to the above weight; the beam had a deflecture of a quarter of an inch, which increased with the weight suspended, to nearly three quarters of an inch, when the fracture took place under the enormous weight of 22 ton 12 cwt. 1 qr., breaking the hoopings short off. By the by, I do not consider it a fair trial, for the beam, so long as the pillars which supported it could move from the perpendicular. I subjoin a *slight* sketch of the beam after the fracture.

W. HOTINE.

[This proof of the strong adhesive power of the cement used by Messrs. Francis and Son, will no doubt come under the notice of many of our engineers at present employed in constructing bridges for the numerous railways now in progress; and where a bridge is not of great span, it would be sufficiently strong to resist the jarring of the engines and carriages going over it. Our correspondent has stated, that iron hoops were laid longitudinally in the brick-rock; now we do not wish to thrust our opinion upon Messrs. Francis and Son, but we merely put the question,—Would it not be a great addition to the strength of a beam of this description, if plates of iron were laid horizontally under it with iron bolts made to pass through them, and likewise through the beam, and then made fast at the top? We should think that Messrs. Francis and Son might be able to turn a small arch, without the aid of centres, with such cement as here noticed.]

## ANALYSIS OF THE CRANK.

NO. II.

*To the Editor of the Penny Mechanic.*

*(Continued from page 258.)*

SIR,—As many inquiries have been made concerning the effective power of the crank, and more especially by your talented correspondent "T. M." I beg to send the following analysis, which I hope will answer at once all the difficulties of your correspondents.

In the crank, as applied to the steam engine, the effect actually produced, is to the effect where the force to act perpendicularly on the crank all the way round, as twice the diameter of a circle is to its circumference, which is very evident; for in any machine whatever, we must always compare the products of the power × by the distance it moves, to the weight ×, by the space through which it moves; in consequence of this, many practical men have considered, that there is no proportional loss of power by using the crank; this is probable beyond doubt, for the power only moves through twice the diameter of the crank's orbit, whilst the crank moves through the whole circumference; but this loss of power is not so great as some may imagine; it is in the ratio apparently of 2 : 3·1416, &c., including any allowance for friction, the power and resistance in this instance being in the same ratio. If "T. M." compares this with the remark, "that the power exercised by a single engine upon the crank does not exceed more than one-third its revolution, is mere conjecture," I think that he *may* elicit some facts that will be of service to him. Now since the power and resistance in these two positions are as $\frac{2}{3.1416}$, &c., if we wish to determine the mean length of the crank, we must multiply the whole length of the crank by $\frac{2}{3.1416}$, or which is the same, by ·6366; that is, when a given force is applied to a given crank to raise a weight, the same effect will be produced if the force be applied at right angles to a crank, the length of which is equal to the length of the given crank multiplied by ·6366, because it must be obvious that the power constantly acting at right angles, must be greater than when it acts only up and down alternately, as is the case in practice; whence, if the power acting at right angles be diminished in the above ratio, by multiplying by ·6366, it will be reduced to a state of equality. We now proceed to deduce a general rule for finding the effective leverage:—Let any circle, A B C D,

Digitized by Google

as in the diagram, represent the orbit of the crank, or the space through which it moves O D, any position of the crank below the horizontal line, and O A any position above it; then to find the effective leverage of the crank in the position O D, produce the line P D, which represents the connecting rod, then this produced line is the direction in which the power acts on the crank; and by the laws of mechanics, a perpendicular on *this line*, through the centre of motion, will be equal to the effective leverage; therefore through O draw O E perpendicular to P D E, which may be determined by trigonometry; for in the triangle O D P, we have the length of the crank O D, the length of the connecting rod D P, and the angle D O P, which the crank makes with the vertical line passing through O, to find the angle O D P, which the power makes with the crank. It is demonstrated in mechanics as a general law, that the effect of a force acting obliquely against a lever, is always as the sine of the angle of direction which the force makes with the lever, and if the length of the crank be multiplied by the sine of this angle, the product will be the effective leverage. The question is now reduced to finding the angle which the power makes with the crank, which we propose to investigate, and give a general rule for that purpose. Now by what has been already stated, we have given two sides and one angle of a triangle to find the rest, which is easily done by trigonometry. Let C = length of crank, L = length of connecting rod, B = angle D O P, and the required angle = to $\phi$, then

$$L : B :: C :: \phi =$$

$$\therefore B = \frac{B \times C}{L} = \text{which is the angle the}$$

connecting rod makes with the vertical line, or the angle A P O, whence we can find directly the angle O D P, and consequently its supplement O D K.

This rule for finding the angle which the connecting rod makes with the vertical, may be expressed verbally as under:—

*Rule.*—Multiply the sine of the angle which the *crank* makes with the vertical line, by the *length* of the crank, and divide by the length of the connecting rod, and the quotient will give the sine of the angle which the connecting rod makes with the vertical, from which the angle O D P may be found. Now it is found in trigonometry, that the sine of any angle is equal to the sine of its supplement, which in geometry amounts to saying that the external angle of any triangle is equal to the two inward opposite angles, as is demonstrated in Euclid; whence we have directly

$$\angle \text{BDO} = \angle \text{DPO} + \angle \text{DOP};$$

and if the sine of the angle E D O be multiplied by the length of the crank in inches, it will give the effectual leverage in inches, from which the effective power of the engine may be readily estimated; for if the power on the connecting rod be multiplied by the length of the lever, the product is the effective force, by the theory of the lever.

The following is an example, giving the length of the connecting rod 5 feet, the length of the crank 1 foot, and the angle which it makes with the vertical line = 60 degrees, to find the effective leverage. The natural sine of 68, which the crank makes with the vertical, is = ·86603, and by the rule $\frac{\cdot 86603 \times 1}{5}$ = ·173206 = the sine of the angle which the connecting rod makes with the vertical, which by the tables of sines = 9°38′, then as above,

$$\angle \text{EDO} = \angle \text{DPO} + \angle \text{DOP}$$

= 9°58 + 69 = 69°·58′, the angle which the *connecting* rod makes with the crank, the natural sine of which is ·93949, and this multiplied by the length of the crank in inches, will give the effective leverage; therefore we have

·93949 × 12 = 11·27388 inches.

And, obviously, to find the effective leverage when the crank is in the position above the horizontal line, is the same, for we have given the angle C O B = A O D, and the two sides, the crank and connecting rod.

I hope this short investigation will prove sufficient to clear all the difficulties of your correspondents, and I hope I have treated so as to render it clear and intelligible to those practical men who may have but a limited knowledge of "decimal arithmetic."

TYRO LOCK.

(*To be continued.*)

*Pneumatics.*—The pressure upon a common-sized man is equal to more than 30,000lbs. weight, because the surface of his body is about 14 square feet, or 2016 inches, and a column of quicksilver 22½ inches high and one inch square, weighs 15 lbs.; therefore the whole pressure will be equal to 30240 lbs. The external pressure of the atmosphere would be fatal to our existence if it were not balanced by an internal pressure which re-acts against it.

Digitized by Google

## ON LEVELLING.

NO. V.

SIR,—Having in the preceding papers investigated most of the necessary rules that are used in reducing levelling observations, I now, in accordance with my promise, beg to send you an example of the method of applying these rules to practice, as example will ever be the best way of simplifying all rules, for whatever purpose they may be intended.

| Back Sights. | Fore Sights. | Distance. | Rise. | Falls. | Reduced Levels. |
|---|---|---|---|---|---|
| 4·0 | 2·0 | 0·0 | 2·0 | — | 2.0 |
| 6·4 | 5·2 | 1·00 | 1·2 | — | 3.2 |
| 8·9 | 7·6 | 2·00 | 1·3 | — | 4·5 |
| — | 4·5 | 3·00 | 3·1 | — | 7·6 |
| — | 3·2 | 4·00 | 1·3 | — | 8·9 |
| — | 6·8 | 5·00 | — | 3·6 | 5.3 |
| — | 8·4 | 6·00 | — | 1·8 | 3.7 |
| 8·6 | 6·3 | 7·00 | 2.3 | — | 5·10 |
| 9·7 | 4·7 | 8·00 | 5·0 | — | 10·10 |
| 8·2 | 8·3 | 9·00 | — | 2·1 | 8·9 |
| — | 4·3 | 10·00 | 4·0 | — | 12·9 |
| — | 3·2 | 11·00 | 1·1 | — | 13·10 |
| — | 2·1 | 12·00 | 1·1 | — | 14·11 |
| 6·4 | 5·3 | 13·00 | 1·1 | — | 16·0 |
| 7·8 | 6·6 | 14·00 | 1·2 | — | 17·2 |
| 57·4 | 40·2 | 14·00 | 24·5 | 7·3 | 17·2 |

The annexed is an example of field-book, as generally kept; some use a different form, but the principle is the same in all of them; this, I believe, has the advantage of simplicity, and for that reason is the most extensively employed. Most books that I have met with in practice are kept in this manner, some having the chainage distance on the outside, to the right, instead of between the fore and back observations; but this is quite arbitrary and adopted at pleasure.

Now subtracting 7 feet 3 inches, in column "fall," from 24 ft. 3 in., in column "rise," we get 24·5—7·3=17·2 which is always the proof of the accuracy of the reduced observations; and by the rules already given, we are to subtract the sum of the fore sights from the sum of the back sights, and the difference is the true reduced level, which above we have shown to be=17·2 feet; and thence, if these differences correspond with the above, we infer the reduction is correct. Now 57.4—40·2=17·2, which corresponds with the above, and therefore is perfectly correct; that is, the difference of level of the two places is 17·2 feet, being 14.10 chains distant from each other by the column distance.

This short example contains every case that can possibly occur in practice, namely, positive, negative, and successive sights. Those sights opposite and corresponding to the blank spaces in column "back" sights, are all simultaneous or successive sights, or they are all referred to the same back sight in the first series 8·9, and in the second 6·2 are the back sights to which each series are referred; and here it must be particularly observed, that in taking the sum of the fore sights, it does not mean the actual sum of all the fore sights under this head; for, in reality, every sight, except the last, *become back* sights, which is sufficiently manifest by attentively considering the case thus 7·6 becomes a back sight to 4·5, and 4·5 again to 3·2 down to 8·4 in the first series, which last is, therefore, the only fore sight, strictly speaking, that need be taken; thence all those sights in the first series, from 7.6 to 6·8, may be omitted, and 8·4 only taken into account. The truth of this is amply proved in the deduced result, and may be further so, by comparing them with some of the geometrical constructions already given, whence we may gain the following rule:—In a field book, whenever a successive series of sights occur, in reducing the levels *omit* them all but the last, which must be added to the rest of the fore sights as usual. If there are more series than one, as in the present example, omit them

Digitized by Google

just the same in every case; thus the actual fore sights in our present case is by what is already said,

=2·0
5.2
8·4
6 3
4·7
2·1
5·3
6·6

40·2

and not the whole of the observations as registered in the column. But when the observations are all corresponding, or when there are no successive sights, then the whole must be taken into account, as by the rules before given, because then every fore sight has a corresponding back sight of its own, and, therefore, each fore and back sights are independent in themselves, and give independent results. This method of reducing the observations is much the shortest, for it saves the trouble of taking the difference of each of the successive sights, as required by most of the other rules. There are a great number of different rules for this purpose, but none are so simple as this that I have seen. The outside column to the right hand under the head "reduced levels," is formed by adding togetlfer all the numbers under column "rise," one by one, and setting them down opposite their respective distances, as in the example; and of course, whenever any negative values or "falls" occur, they must be deducted, as will be readily seen by tracing the column down: then by tracing their respective heights and their distances from the starting point, we can readily form a "section," as it is technically called, which is done as follows:—Draw on your paper an indefinite straight line, assume the starting point, from which point set off your first distance, and at this distance erect a perpendicular, either above or below the line, as the case is, equal to the first reduced difference, under column "reduced levels;" then set off from this point your second, third, fourth, &c., distances, erecting their corresponding heights at every point, and so continue on for the whole length of the measured distances; then join the top points of every one of these perpendicular heights, and the "section" will be complete; the lengths and heights must be marked to each distance and height, &c.

The section may be made to any convenient scale, generally ten chains to the inch. If great care is taken in laying down the section, the cubical contents, areas, inclines, &c., may be taken by the scale, which saves the trouble and time of numerical computation, and this mode, for the sake of ease and expedition, is generally adopted in most engineers' and architects' offices. My next paper will give the method of reducing the inclines, finding the averages, &c., preparatory to finding the areas and cubic contents of the cuttings and embankments, &c.

I remain yours, TYRO LOCK.

## ELECTRICAL TELEGRAPH.

*To the Editor of the Penny Mechanic.*

SIR,—In answer to your correspondent, "Theta," who seems to entertain many supposed difficulties in my plan, I beg leave to say, that I do not entertain any fears respecting the use of a metallic pipe. If the theory on which I have laid my plan is correct, there will be no difficulties in the way, and it is better to have no unnecessary appendages to it. I apprehend that if the receiver be placed within half an inch from the end of the wires, while we observe a greater distance between the wires, and also from the outer wires to the metallic pipe, say an inch or more, if needful, that the fluid will pass through the nearest channel to the earth; of course we could not allow any angles or points in the construction, which would either give off or receive the fluid.

If my theory be established by fact, "Theta" will find that we can dispense with his glass tubes and his logs of charcoal, which latter substance he says is not generally known to be a non-conductor; no, I believe not, nor is it a fact, for which information I need only refer him to page 245 of No. 71 of your Magazine, which brings me his communication. I expect that the galvanic battery will be found most convenient for accumulating the fluid in sufficient quantities.

Another Correspondent, "N. S. N.," has obliged me with a few friendly hints respecting it, for which I thank him, although I differ from him with respect to laying aside the letters of the alphabet; the expense of the additional wires as a public thing is not worth a thought, and the adapting it in case of need for easy private communication, is, in my opinion, not one of its least recommendations. His greatest difficulty appears to be the mending of a broken wire; had I but few wires such an accident would probably throw the telegraph entirely out of use, until some means had been found to repair it; but how stands the case when I have all

Digitized by Google

the letters of the alphabet, how easy will it be to substitute for the broken letter (if it be one of great importance) another wire containing a letter of less importance, as we know there are letters that might very easily be spared: or again, to provide for a rainy day by having two or three more wires than we have immediate occasion for. To this I need only add, that care should be taken in the first construction, to have the wires sufficiently stout, and well rivetted and soldered at the parts where they are joined. I hope now I have said enough to quiet the minds of your correspondents, who really appear to have been very easily alarmed.

One improvement has struck me since I wrote my last letter, which I will take this opportunity of publishing; it is that points be substituted for the nobs or balls at the end of the wires, which will give out the fluid more freely and take a longer time in passing off, allowing the person who is copying the communication a more distinct view of the letter on which the fluid is playing. Your's truly,

*London, Feb.* 24th. L.

## BOTANICAL SOCIETY OF LONDON.

*Instituted November* 29, 1836; 75, *Newman Street, Oxford Street.*

To those of our Readers who take delight in the beautiful science of botany, and who may not be acquainted with the rules and regulations, (or perhaps even the existence) of the above society, the following synopsis will no doubt be of interest:—

The Botanical Society of London is instituted for the promotion and diffusion of botanical science, by the formation of an herbarium, the exchange of specimens with other societies, or with individuals, the reading of original and other papers, the formation, also, of a library and museum, and by the establishment of a botanic garden, as soon as the funds of the society will permit.

The number of British plants received amount to 4,819 specimens, including ferns; 767 species, including 1,313 specimens, have been arranged in the herbarium, according to the system of De Candolle. The remaining 3,506 duplicates, including 515 species, will be distributed to those persons who have favoured the Curator with lists of *desiderata* for that purpose.

In addition to the extensive and valuable collection of British plants, the council beg to announce the receipt of a large collection of French plants, supposed to be a portion of the Herbarium of Jean Jacques Rousseau, together with some plants from Mahon, Minorca, presented by the secretary. Another collection of foreign plants from America, collected by the officers of the Hudson's Bay Company, has been presented by Joseph Freeman, Esq. Also specimens of *Lycopodium Circinnatum*, from the president, sent by Dr. Forbes, F.R.S. of Chichester. Specimens of three new British plants have been received, viz, *Claytonia Alsinoides*, from Mr. W. Baxter of Oxford; also a moss, new to Britain, *Cinclidium Stygium*, from Mr. Leyland of Halifax; and specimens, of which there are many duplicates, of *Spartina Alternifolia*, from Itchin Ferry, Southampton, presented by Dr. Macreight, V.P.

The society have also received from Mr. R. H. Schomburgh, now travelling in British Guiana, papers accompanied with drawings on the two following interesting plants, which were read before the society, viz.: *Victoria Regina* and *Loranthus Smythii*. Also donations of seeds from the Cape of Good Hope, presented by M. Schmidt.

The meetings of the society are held every first and third Friday of the month, from November to June; and on the first Friday of every other month, at their Rooms, No. 75, Newman Street, Oxford Street, at 8 o'clock, p. m. precisely, where all communications to the secretary are requested to be addressed.

Ladies are eligible as Members, upon the same terms, and possess the same privileges as gentlemen.

Previous to the ordinary meetings, commencing March 2nd, 1838, at 7 o'clock, p. m. precisely, the Curator will commence a Course of Lectures on the Practical part of Botany, to which the Members and their friends, (ladies and gentlemen) are invited to attend.

*Annual Subscription.*—Resident Members, One Guinea; Corresponding Members, Half-a-Guinea. Admission Fee, Half-a-Guinea.

---

At a meeting of the above society, March 2nd, John Reynolds, Esq. M.M.S., &c., Treasurer, in the Chair; Daniel Cooper, Esq., A.L.S., Curator, delivered a highly interesting and useful lecture, introductory to a series of lectures on botany, in which he explained the various species of roots, which were illustrated by a number of well-executed diagrams. The lecturer also ably pointed out, from an interesting diagram, the geographical dis-

Digitized by Google

tribution of the vegetable kingdom; and enumerated the number of species of plants known at different periods from the earliest knowledge of botany, (at which period only seventy-six species were known) up to the present time; the number of known species being now upwards of sixty-thousand.

After the lecture was concluded, W. H. White, Esq., S. M. S., read a paper on a new species of *Epilobium*, which had been cultivated from seeds sent from Central Russia. This new species of *Epilobium* seems to be intermediate between *E. Augustissimum*, and *E. Rasemarinifolium* of Staenck. It has been named *E. Canesceus*. The *E. Rasemarinifolium* appears to be the same plant which has been found plentifully by *Bigelon*, in the environs of Philadelphia, U. S., and which he has called *E. Lineare*. *Nuttal* has found the same plant near Boston N. A., and calls it *E. Squammatum*.

The *E. Augustissimum*, Curt: Bot. Mag. Pl. 76, is the *E. Dovonæi* of Allieni, *E. Lobelii* of Villaes, *E. Halleri* of Retz, and the *E. Augustissimum B Alpinum* of Sering.

## ON THE POWER OF THE CRANK.

*To the Editor of the Penny Mechanic.*

SIR,—I should have felt myself particularly obliged had "Q. E. D." proved in a clear and intelligible manner, that my plan of calculating the power of the crank, (that *important* member of the most valuable of all machines) was incorrect; but, no, he desires to "avert an impending controversy," and thereby check inquiry, prevent useful discussion, and mistify instead of simplifying the intricate rudiments of mechanical science.

The peculiar "strange" notion which enabled an "unlettered self-taught peasant," James Brindley (see No. 27, Vol. 1.) to overcome every obstacle in levelling and forming canals, erecting the most powerful steam-engines of his day, will, perhaps also appear, "very strange" to your correspondent "Q. E. D." He says, "the whole force of the steam expended in raising the piston, is effective in the production of rotary motion in the crank." Does "Q. E. D" mean, that the steam is as powerful upon the piston and crank, when the former is commencing its descent from the top of the cylinder, and the latter from the "dead centre," as it is when the piston has made half the stroke, and the crank is at full power or leverage? If he does, then I want proof founded upon practical knowledge.

Let "Q. E. D." start an engine when it is loaded nearly equal to its power, and the crank is at the dead centre; although the steam may be at high temperature, he will be obliged to apply crowbars at the circumference of the fly-wheel to assist that "important member" (crank) in its approach to full power; when a few vibrations between the centres will be necessary, to impart momentum to the wheel, and to form a vacuum before the fly-wheel will be enabled to make a revolution.

Again, "that when the crank is at Zero no steam is expended." Then it follows that the machine itself must be defective as well as the crank, and a continued rotary motion cannot be produced in the crank by the force of steam alone.

Again, "The force is unequally distributed, but not diminished." Strange "Q. E. D." I should very much like to have this gentleman; this master-piece of machinery, turning a five-feet grind-stone with a fourteen-inch (crank) handle. I would engage to find out his dead centre "Zero," although he may form himself into any angles, with the handle most favourable to power; and flatter himself that his "force" remains undiminished.

"Q. E. D." further asserts, "The effect is exactly the same as if the piston were to act successively upon all the parts of a straight lever, extending from the centre to the circumference of the circle described by the crank." How is this assumption proved? I will maintain until I am convinced to the contrary, that the use of double engines is merely to effect regularity of motion, and not the increase of power. The crank, acted upon by the piston, and paddle wheel, (the resistance at the circumference) turning on the same axis, is as a lever of the first order. The effective power and weight is as the distance between the points of action, and the (axis) fulcrum. I would recommend "Q. E. D." in order to test the point in question, to procure an old woman's spinning-wheel, (See No. 22, fig. 3, Vol. 1,) to suspend a weight from the crank, and a weight from the circumference of the wheel, to ballance when the crank is placed in an horizontal position, and in putting the wheel and crank in motion he will discover his error.

Your humble Servant,
Feb. 22, 1838. THOMAS MATHEWS.

P. S.—I am obliged to Mr. Thomas for his kindness in explaining the table, and I beg to inform him that I have directed my attention to the properties of the crank

Digitized by Google

for some years, and have discovered an effective substitute for the crank, capable of receiving and exercising full power on every part of its rotary motion; but want of means has obstructed my progress with it.

## ON THE NATURE AND PROPERTIES OF STEAM.

### NO. VII.

### VIS VAPORIS.

THE *single acting engine* of Watt, differs from the atmospheric very little, and in this particular, that instead of the atmosphere pressing down the piston as in the atmospheric engine, after the formation of a vacuum beneath the piston, it is in the single-acting engine pressed down by the steam from the boiler. The cylinder having a cap, instead of the open top, as in the atmospheric engine. The upstroke of the piston being effected in both in the same manner, viz. by a counter weight on the pump rod (if a pumping engine), or on the end of the working beam. Before the time of Watt, the condensation of the steam was effected by the injection of a jet of cold-water into the cylinder, so that the cylinder was alternately heated and cooled every stroke, causing a great loss of steam, and consequently expense of fuel. By the introduction by Watt, of the method of condensing in a separate chamber, this loss was prevented; though in parts where fuel is very cheap, engines on the original plan, are, or were till very lately at work. Many atmospheric engines, are now however fitted with condensers, by which means they are rendered nearly as efficacious as the single-acting.

C. D. T.

## LECTURE ON MECHANICAL AGENTS.

### BY DR. LARDNER.

DR. LARDNER concluded his course of lectures on Mechanical Agents and Powers on Friday last, the 9th instant at the Mechanic's Institution, the subject of which was as follows:—

After the usual exhordium, and a brief recapitulation of the main subjects of the last lecture, in which he had alluded to the property of steam, he proceeded to explain, upon the most elementary principles, the properties of solids and fluids, merely in reference to the difference of their natures, as applicable to the purposes of man as mechanical agents. We will pass over the definitions of a solid body, as they are too well known to require recapitulation here, and proceed to an elementary property of fluids, distinguished as elastic and non-elastic. In the case of the latter, they always require an auxiliary power from some other force to assist them, either as a direct power or as a secondary agent; thus, for the care of water, to render it available as a mechanical agent, it will require the intervention of some force, as that of the mill-stream, requires that the source of the water should be considerably elevated above that point in its course where it is intended to act as a power in any machinery, or else it will require a direct communicated power, as in the case of hydrostatic presses, &c.; or, thirdly, the application of heat, by which its temperature must be raised, and converted from a *non-elastic* fluid—water, to a highly elastic fluid—steam; by itself alone, without the intervention of some of these or other powers, it will not be at all available as a mechanical agent. Elastic fluids are somewhat the same, which we will point out. Let us have a square box of any given dimensions, and let it be filled with any *non-elastic* fluid, say water, then by the hydrostatical powers, or laws of these fluids, the pressure of the fluid on the base of the box will be equivalent to the whole weight of the fluid contained in it, which is manifest, for the whole of the fluid rests on the base of the box, and consequently presses it proportionably, whilst the pressure on the sides is but about half the weight of the fluid; and if we were to shut the lid of the box, there would be no pressure *on it*, which may, indeed, be said to be a distinguishing property of non-elastic and elastic fluids.

The non-elastic fluids, as we can see from the example of the box, cannot have any effect on the lid, either upwards or downwards, and consequently the only pressure on the lid is that of the ordinary pressure of the external atmosphere. But the case is very different in elastic fluids, as we will now prove. Suppose that box before mentioned is of iron, and full of water, and let a lamp be now applied to it, the temperature of the water will be raised, and it will soon begin to boil; the consequence is, that a highly elastic fluid is formed, which fluid is much lighter than the atmosphere in an ordinary state, and it, therefore, as a consequence of the

Digitized by Google

property of hydrostatics, endeavours to ascend, but the lid being supposed to be closed, it necessarily encounters a resistance from the lid of the box; the heat being continued, the generated steam becomes more and more highly elastic, and at length bursts the lid of the box; and thus in every case of an elastic fluid is there always an upward pressure, which is distinctly contrary from the beforementioned property of water, though water itself will press powerfully upwards against any body floating on it; and it is this upward pressure of the water alone which causes a body to float; therefore, as a natural consequence, all floating bodies must be lighter than water, bulk for bulk; thus, for instance, gold, which is about nineteen times heavier than water, would not swim unless the water was nineteen times more dense than ordinary, whence arises the theory of the specific gravity of bodies.

The properties of elastic fluids already mentioned, are not the only ones; they admit of a directly contrary case. After having been expanded by the absorption of caloric, they may be again contracted to their original dimensions, by abstracting from them the caloric which they have absorbed, as we have already pointed out in the case of the tube and piston mentioned in the last lecture; and from these properties arises one of the most gigantic powers, applied to useful purposes by the inventive genius of man; this application is the steam engine, which we shall now endeavour to render intelligible to your readers, as far as it is possible to do without the aid of diagrams, and as far as may be consistent with brevity and perspicuity.

Suppose, now, that we have a cylinder with a moveable but air-tight piston, connected to a boiler in which steam is generated, so that the steam from the boiler may, by the aid of pipes or other suitable apparatus, be led directly to the bottom of the cylinder, and that by the aid of a stop-cock, or similar contrivance, we can admit steam at pleasure, and in any convenient quantity, into the cylinder. Suppose that the piston is at the bottom of the cylinder and the stop-cock closed, now by the natural inertia of the different parts of the apparatus no motion will ensue; then let us suppose the stocp-cock to be suddenly opened, the steam from the boiler, by its superior elasticity and expansive force, rushes into the cylinder, and striking against the piston with a force proportional to the difference of the pressure of the steam on the piston and the pressure of the external atmosphere, the piston is now forced to the top of the cylinder; and if the stop-cock was left open and the heat continued, it would remain there, and perhaps burst the cylinder. We have already shown, that the steam will admit of contraction by being cooled down, consequently if the stop-cock is closed and the cylinder cooled, the piston will immediately descend to its first position. But it must be directly obvious, that if the cylinder is cooled down to the temperature of the atmosphere to allow the piston to descend, the next time the stop-cock was opened to admit steam again into the cylinder to force the piston up, it would also be contracted or condensed, and, consequently, the piston could not ascend, whence we see that cooling the cylinder will not do, if we wish to apply this usefully to practical purposes. The celebrated Watt was the person who first applied a method of condensing the steam without cooling the cylinder, which may be described nearly as follows:—Suppose we have a square box either containing cold water, or, what is much better, submerged under water like a diving bell, so that it may always be kept at a much lower temperature than the surrounding media, then let a pipe lead from this to the bottom of the cylinder, or it may be equally convenient if towards the top, and fastened with a stop-cock in every respect similar to the pipe leading from the boiler, open the steam pipe stop-cock, and the steam instantly rushes into the cylinder and forces the piston up before it; and now to condense the steam, shut the stop-cock leading from the boiler, and at the same time open the cock leading to the submerged box, or what is technically termed the condenser, and the steam immediately rushes from under the piston in the cylinder, down the open pipe into the condensing box, and the coldness of the box instantly contracts or converts the steam into water at nearly the same temperature as the water surrounding the submerged box or condenser; then the steam being thus condensed, and a vacuum formed under the piston, the pressure of the external atmosphere on the upper portion of the piston, forces it down to the bottom to its original position. Now closing the stop-cock leading to the condenser, and opening that from the boiler, the steam as before rushes into the cylinder and forces up the piston; open the condensing stop-cock and the steam is again condensed, and the piston accordingly again brought down, and thus an alternate upward and downward motion is given to the piston

Digitized by Google

by the reciprocal expansion and condensation of the steam. This is the elementary principle of every condensing steam engine, however complicated its machinery and works may be; they all are resolvable into this principle.

The principle already explained is that upon which the engines, commonly called low-pressure engines, are made; from the details just given it is sufficiently easy to see how an engine is constructed from these principles; for if we suppose an inflexible rod or bar attached, or rather constituting the piston, be attached by a series of parallel bars, technically called parallel motion, to 2 strong iron bars vibrating on a centre similar to the arms of a common balance, every time the piston is forced upwards by the mechanical action of the steam in the cylinder, the iron beam is made to vibrate upwards at the end connected to the piston, and downwards at the opposite end; to which a pumping apparatus may be conveniently fixed; and, consequently, every time the piston descends by the condensation of the steam, the external atmospheric pressure forces the piston down to the bottom of the cylinder, and thereby elevates the pump end of the vibrating beam, and thus can raise a quantity of water at every descent of the piston. This is the principle upon which the pumping engines of the mining districts are made; but a far more powerful and effectual mode of working steam as a mechanical agent, is by taking advantage of its expansive qualities, and applying it as an expansive agent. Now we know that if any elastic fluid be compressed by a given weight, it will possess a known volume; but if we remove this weight it will immediately expand, and occupy many more times its previous space; but the elasticity of fluids are known to be proportional to their density, consequently the more an elastic fluid is compressed the more dense it will be, and therefore the more elastic, or more powerful as a mechanical force; this is plainly exemplified in the air-gun, the air is condensed in a separate chamber, and by opening suddenly a valve the air by its expansive force rushes into the barrel of the gun, and forces out the ball with immense velocity, which velocity will be proportional to the weight of the ball and the density, or rather the condensity of the fluid; for the more it is compressed the more violently it forces out the ball; and upon a similar principle advantage is taken of the expansive properties of steam; for suppose we have a cylinder of known dimensions, and as before, accurately fitted with a piston, moving free, but perfectly air-tight; if we admit steam into this cylinder under the piston, and leave the valve from the boiler to the cylinder open till the steam has forced the piston to the top of the cylinder, and then closed previous to condensing the steam, the only effect produced will be that already described; and obviously the cylinder will then be filled with steam of the same density and temperature of the boiler, from which the steam in the cylinder was obtained. And consequently, if this be condensed, we shall at every condensation have to *condense* a cylinder full of steam of the density of the steam in the boiler; but if, when the steam is forcing up the piston, we close the valve from the boiler, when the steam has forced the piston *only half way up*, the piston will be driven up at the same velocity as the former by the expansion of the steam; and we can now see the saving in both steam and fuel in using an expansive engine, for in the first case a cylinder full of steam of the density of the boiler has to be condensed, whilst in the latter, since the steam valve is closed at half the elevation, and the steam expands through the rest, it is consequently only half as dense as that in the former instance, and also only *half* the former quantity is used; for plainly the cylinder was only half filled with steam at the same density as that in the boiler, whence the saving of steam is manifest as well as the economy of fuel. And we now proceed to show that there is a corresponding *gain* of *power*; for let the cylinder be 1 foot high, and of any convenient diameter, and the piston weigh 15 pounds, which consequently in our case will be the load of the engine; let the steam be admitted under the cylinder, and when it has forced the piston up 6 inches, stop the steam, and the piston will be carried to the top of the cylinder by the expansion of the steam, so that in this case the same amount of work will be done with only half the quantity of steam. Now again, suppose the steam carries the piston as in the first case 1 foot high, and then 7½ lbs. to be taken from the piston, or its weight be reduced one-half, the steam immediately expands to twice its bulk, and consequently raises the piston (now weighing 7½lbs.) 2 feet high. Again, suppose the piston to be reduced to 3¾lbs. the steam immediately expands again about six inches, so that the piston weighing 3¾ lbs. is now lifted about 32 inches high, and consequently the following amount of labour is done: the piston

Digitized by Google

weighing 15lbs. is raised 1 foot, when only weighing 7½ lbs. it is raised about 2 feet, and when only weighing 3½lbs. it is raised about 32 inches with the same amount of steam as required when working unexpansively to lift the piston, weighing 15 lbs. 1 foot high; so that we can get double the work done with the same quantity of steam, when acting expansively, as when acting unexpansively.

But this amount of labour will not be obtained practically, for the weight cannot be halved at pleasure, independent of other causes, and instead of expanding and forcing the piston upwards, it works contrarily, and is employed in forcing the piston downwards; these are the steam-engines employed in the different mines in Cornwall, where almost incredible results are obtained. The next species of engine to be described is the high-pressure, or more properly, the non-condensing engine.

Imagine a cylinder similar to those already described, having four pipes communicating with it, two to the atmosphere and the other two to the boiler; let two of these pipes act on the top of the piston, being placed on the top of the cylinder, directly opposite to each other, one of them of entrance and the other for the escape of the steam, and the other two at the bottom of the cylinder, opposite to each other, and for the same purposes as the other two, and let them act diagonally, that is when the steam is flowing in at the top entrance pipe, let it be escaping from the bottom exit pipe, so that we can dispense altogether with the condensing machine; for after the steam has done its work it is allowed to escape into the atmosphere; the principle of the action of this machine is nearly as follows. Shut the valve leading to the atmosphere at the bottom of the cylinder, and open that leading to the boiler, and the steam rushing in raises the piston, closes the steam admission valve at the bottom and open the exit valve; and at the same time open the valve communicating to the boiler from the top of the cylinder, and the steam rushing in forces the piston down, the steam that had first raised the piston escaping through the open valve at the same time, and this being continued alternately gives motion to a suitable apparatus, as required.

The high-pressure engine is that used in locomotive carriages, from their convenience in not having so incumbering an apparatus as a condensing machine, when they are applied as a moving power to these engines. The cylinders in which the pistons work are generally laid horozontally under the carriage; two cylinders are always used, one to each side of the carriage, they give motion to the wheels in the following manner: the cylinders are mostly fixed just under the axles of the hind wheels, and the connecting rod of the pistons are attached to two cranks on the axle of the fore-wheels; they work alternately, when one is pushing the crank in one direction, the other is pushing the second crank in the contrary direction, and these turn the axle to which the fore-wheels are attached round, which, meeting with a strong friction from the surface of the rails on which the wheels move, the whole machine is propelled forward with a velocity proportional to the stroke of the engine, the diameter of the wheels, and the leverage of the crank, or perhaps more rigourously speaking, proportional to the wheels and piston; thus suppose the circumference of the wheels to be ten feet, and the length of stroke one foot, whenever the piston completed one stroke, the carriage would necessarily move the length of rail equal to the circumference of the wheel, therefore the greater the number of strokes per minute and the greater the circumference of the wheels, the greater will be the velocity of the engine; the average velocity at present may be about thirty miles per hour. But Mr. Brunel, on the Great Western Railway, by taking advantage of the foregoing principles, will nearly double that velocity, with the mail-trains, for he intends having the wheels of double diameter to the present, and to ensure safety he has laid his rails considerably wider than usual; this of course will reduce the centre of gravity of the engine and train much lower than at present, and avoid the danger of overturning at such high velocities; it is expected that by combining these principles he will run his mails at a velocity of between fifty and sixty miles per hour.

Having thus briefly explained the elementary principles of the different steam engines now used, we proceed to offer a few remarks on their most requisite and essential attendant, the boiler, for without this apparatus, as is well known, the steam engine could not exist.

The forms of steam-engine boilers are nearly as varied and numerous as any of the common culinary apparatus for a similar purpose; but that which is mostly used is cylindrical, or on many occasions globular. The principle to be obtained in a boiler for the double purpose of economy and expedition, is the greatest amount of

Digitized by Google

surface exposed to the action of the fire, in the least room possible. The earliest boilers appear to have been tubular, or something similar to an ordinary copper, covered with an hemispherical or segmental top, and in the earliest engines the cylinders were sometimes in the boilers, at other times just above them.

Some of the steam-boat boilers of the present day are square or rectangular, with a semi-cylindrical roof, pierced as usual for safety valves; but by far the best and most convenient is the cylindrical boilers, with segmental or hemispherical ends; these are those that appear to be in the most repute practically; but the forms are very various, every engineer having a shape of his own. Some boilers have been made cylindrical, with alternate layers of fire and water, similar to cylindrical galvanic apparatus, acid, copper, and zinc; some have been made like a parallel row of tolerably thick pipes, and some have been made cylindrical, with a number of small iron pipes running longitudinally through the boiler, through which pipes the fire is forced by the very powerful draught of the furnace or flues. Boilers of this description are frequently used on locomotive engines, which of all other engines require the greatest exposable surface in the least possible room. But one of the most novel ways of generating steam, is that *without* a boiler. A small cistern of mercury is placed in the flue or chimney, and raised to a very high temperature, and drops of water are allowed to fall on it, which, by the intense heat of the mercury, is immediately connected into steam, and is then conducted by means of pipes to its proper sphere of action. In the locomotive engines, it must be observed, that the steam is there worked on the high pressure principle, by which the heavy and cumbrous apparatus of condensing is avoided; and in these engines an intense heat is required for generating the necessary supply of steam; and it is commonly known, that to any steam-engine or other furnace, the longer the chimney the greater the draught, and, consequently, the greater the power of the fire, for a long chimney may be considered as nothing more than a great pair of bellows, for it answers precisely a similar purpose, namely, that of forcing a greater quantity of air in the fire, from which air the fire derives the principle of its heat by absorbing oxygen; but it must be obvious, that in a locomotive engine a long chimney cannot be used, whence arises a difficulty of keeping up a fierce fire; but this is obviated by a very simple contrivance, and equally, if not more effective, than either a chimney or pair of bellows; the steam, after having done its work in the cylinder, is carried by pipes to, and discharged up, the chimney, and thus a great draught is obtained, sufficient to answer all the purposes required; now any person who has heard the beating of the pistons of the steam-engine at a distance, must have remarked the great rapidity of the strokes or pulsations, so fast that it would defy any attempt to count them; and at every one of these strikes a quantity of steam is ejected from the cylinders after having done its work, and consequently, at every successive stroke, a blast of steam is driven up the chimney, which, by its superior force, drives out the air in the upper part of the chimney, and the cold atmosphere rushes through the fire, to fill up the vacuum thus formed in the chimney: in this way they obtain a sufficient draught, so that the steam not only drives the engine, but performs the office of a pair of bellows at the same time, indeed so fierce is the combustion, that two or three trips is often sufficient to fuse the grating at the bottom. The lecturer stated, that being once on an engine experimenting on the Manchester Railway, the heat was so intense, as to fuse a *new* grating in less than an hour. We may form an idea of the intensity of the fire on this occasion, by observing, that the back of a domestic kitchen fire-grate is seldom, if, indeed, ever fused, by the most powerful fire they can obtain, which in great houses is far from being contemptible, from the immense height and consequent draught of the chimney.

It is a matter of observation, that all boilers lose much of their heat, like all other bodies, by radiation; for if any medium, as the atmosphere, colder than a heated body, comes into contact with the heated body, it imbibes some of its heat. This being the case with steam-engine boilers, they have endeavoured of late to remedy this, by covering or inclosing them with any non-conducting substance, such as shreds of flannel, blankets, &c.; but in the Cornish engines they now invariably cover them with a casing stuffed with fine sawdust, which prevents the loss of heat by radiation, and consequently economises the fuel; but not only the boiler emits a great part of its heat, but every other part of the machinery in connection with the steam. The loss of steam from condensation in the pipes is very great, almost beyond conception; but by covering them with rope, flannel, or casing them in saw-dust, this loss is

Digitized by Google

very sensibly diminished; and in every case where the machinery is distant from the boiler, they always take care to cover it with some non-conducting surface. The loss is very great from every other part of the machinery, as the cylinder, &c., but which, by being kept constantly bright and polished, does not lose its heat; for it is well known that polished surfaces do not radiate heat so readily as rough unpolished surfaces, therefore this polishing is not only a matter of neatness, but of actual economy.

I will now take my leave of this subject for the present, and will return to it ultimately by way of commentary; hoping that these brief outlines of the science of mechanical forces has not been unacceptable.

TYRO LOCK.

March 12th, 1838.

## DR. ARNOTT'S THERMOMETER STOVE.

*To the Editor of the* PENNY MECHANIC.

SIR,—I beg to inform your Correspondent "J. S. D." if what he states to be the principle of Dr. Arnott's thermometer stove, viz. a simple box of iron containing fire, with only as much air admitted by a valve, &c., opening into the ash pit as is just sufficient to feed combustion, &c. It is correct that it is one of the best and most economical modes yet invented; but I beg to inform "J. S. D." that I have a patent for burning combustible bodies in air-tight chambers, kilns, ovens, &c. (admitting air by the ash pit), for heating large bodies to a red heat, &c. Now this is my principle, and I am sure that Dr. Arnott would be the last person to assume as his invention one which has been patented upwards of four years. I perfectly agree with "J. S. D." wherein he says, that "these boxes being constructed on philosophical principles, they are calculated to effect a better or more complete combustion of fuel than any other method yet discovered, and that they are a saving of fuel either upon an extensive or small scale, and that to a very considerable amount. Will you, Sir, have the goodness, through the medium of your journal, to oblige me by stating where Dr. Arnott's stove can be seen in operation.

I remain yours, &c.

J. I.

17, Bennett's-buildings, Kennington-lane, Feb. 27, 1836.

[If the principle of Dr. Arnott's thermometer stove should prove to be the same as that of our Correspondent, we would advise the latter to say as little about the matter as possible; for, from all we can learn, the invention is a failure. The stove can be seen at the Athenæum Office, Wellington-street, Strand.—The insertion of this letter has been unavoidably delayed in consequence of "J. I." having sent it to the publisher instead of our office.]

## SCHOOL OF DESIGN.

WE were admitted on Tuesday last to view the drawings of the students of the School of Design, established a few months since by Government, and were highly gratified. The drawings, generally, did great credit equally to the masters and the pupils; and it was impossible not to feel the immense influence which such a system, if persevered in, must have ultimately on the manufactures of the country. It appeared, from inquiry, that the majority of the students were the sons of respectable tradesmen. We confess that we would willingly have found among them a few youths from a humbler class—the sons of those horny-handed mechanics, whose fate it will be to execute what others design; but these will probably follow, when success shall enable the Council to reduce the monthly payment. Among the drawings which appeared to us to deserve especial mention, were those of Brett, Wild, Bond, and Winsor,—the last is a deaf and dumb youth; and a model by him, in plaster, from an antique frieze, was in a fine bold style, and full of promise.—*Athenæum.*

*Method of Wetting Paper for Bank-Notes.*—The paper is laid between two small boards, and put into a vessel of water; the vessel is then put under the receiver of an air-pump; the air is then exhausted and bubbles out of the paper; the air is then let in again, when it presses the water with such force as to drive it into the paper, and thereby preventing its being torn, as it would be if wetted singly. This is the way the charcoal is prepared which is used at the Jerusalem Coffee House; only, instead of water, there is some preparation used which is mixed with the latter, and it is then allowed to evaporate, leaving the mixture in the pores of the charcoal, which keeps the carbonic acid out.

Yours, &c.

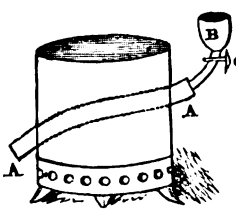
D. E. Q.

Digitized by Google

# THE CHEMIST.

## OIL GAS.

When oil is subjected to a red heat, excluded from air, it is decomposed; its elements enter into a new state of combination, and a large quantity of gaseous matter, now called oil gas, is given off, which affords, by its combustion, a brilliant light, and which, as oil is composed chiefly of carbon and hydrogen, the proportion of oxygen being very small, contains little carbonic acid, and is entirely free from sulphur. For this reason it does not require to be purified; hence the method of preparing it is much more simple than that for procuring coal gas. For this purpose a reservoir full of oil is connected by a tube, with a cast-iron retort placed in a furnace, and from the opposite end of which these tubes pass to the gasometer. Having stuffed the retort with pieces of brick or coke, it is made red hot, and the oil is then allowed to flow in, in a small stream; the use of the coke or brick apparently being merely to retard its progress, and thus expose it more completely to heat. The moment it enters the retort it is decomposed, gas is formed, and it passes into the gasometer. During its passage through the tubes it deposits a little volatile oil and acetic acid, which are drawn off by a stop-cock attached to them; but it still retains part of the former, which gives to it its peculiar odour. The manufacture of oil gas, on a small scale, may be shown by a very simple apparatus:—To the end of an iron tube, A,




stuffed with pieces of coke, and passed through a chauffer to bring it to a red heat, adapt a tinned iron funnel, B, with a stop-cock, C, having previously connected the opposite end to a gas-holder. The funnel being filled with oil, and the tube properly heated, the stop-cock is to be opened and almost immediately shut, by which a little oil is allowed to flow in, and the moment it falls on the hot tube, gas is given off, so that by repeatedly turning the cock, a sufficient quantity may be formed to fill the gas-holder.

J. R. Watts, M.D.

## MUSICAL BAROMETER.

A gentleman at Burkli, by the name of Ventain, not far from Basle, in Switzerland, invented, some years ago, a sort of musical barometer, which has been called in Germer, *wetter harfe*, weather harp; or *riesen harfe*, giant harp, which possesses the singular property of indicating changes of the weather by musical tones. This gentleman was in the habit of amusing himself by shooting at a mark from his window, and that he might not be obliged to go after the mark at every shot, he fixed a piece of iron wire to it, so as to be able to draw it to him at pleasure. He frequently remarked that this wire gave musical tones, sounding exactly an octave, and he found that any iron wire, extended in a direction parallel to the meridian, gave this tone every time the weather changed. A piece of brass wire gave no sound, nor did an iron wire extended east and west. In consequence of these observations a musical barometer was constructed. In the year 1787, Captain Haas, of Basle, made one in the following manner: Thirteen pieces of iron wire, each 320 feet long, were extended from his summer-house to the outer court, crossing a garden. They were placed about two inches apart; the largest were two lines in diameter, the smallest only one, and the others were about one and a half. They were on the south side of the house, and made an angle of twenty or thirty degrees with the horizon. They were stretched and kept tight by wheels for the purpose. Every time the weather changed, these wires made so much noise that it was impossible to continue concerts in the parlour, and the sound sometimes resembles that of a tea-urn when boiling, sometimes that of an harmonica, a distant bell, or an organ. In the opinion of the celebrated chemist M. Dobereiner, as stated in the *Bulletin Technologique*, this is an electro-magnetical phenomenon.

## CURIOUS EXPERIMENT.

In 1778, Herrisant, a French philosopher, enclosed three toads in boxes, and covered the boxes with plaster of Paris, to the complete exclusion of air. He then deposited the boxes at the Academy of Sciences, at Paris, and in eighteen months afterwards they were opened. Two of the toads were found living, and one dead. Unfortunately, the dimensions of the boxes have not been recorded. Dr. Edwards, also made some experiments of a similar nature.

Digitized by Google

# INSTITUTIONS.

## *List of Literary and Scientific Institutions for the People existing in London.*

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Lectures every Wednesday and Friday evenings, at half-past eight o'clock. Members' subscription 6s. per quarter. Entrance fee 2s. 6d.

*City of London Literary and Scientific Institution*, Aldersgate-street.—Lectures every Wednesday evening, at eight o'clock. Subscription 2*l.* 2s. per annum.

*Milton Institution*, Milton-street, Fore-street.—Lectures on Monday evenings, at eight o'clock. Subscription 1*l.* per annum.

*Lambeth Literary and Scientific Institution*, Wellington-terrace, Waterloo Bridge Road.—Lectures Tuesday evenings, at half-past eight o'clock. Subscription 1*l.* 11s. 6d. per annum.

*Southwark Literary Society*, 37, Bridge House-place, (near Southwark Bridge).—Lectures on Wednesday evenings, at eight o'clock Subscription 1*l.* 10s. per annum. Admission Fee 10s.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Lectures Thursday evenings, at half-past eight o'clock. Subscription 2*l.* 2s. per annum.

*Westminster Literary Scientific and Mechanics' Institution*, Smith-street.—Lectures Thursday evenings, at half-past eight o'clock. Subscription 6s. per quarter.

*Mary-le-bone Literary and Scientific Institution*, Edward-street, Portman-square.—Lectures every Monday evening, at half-past eight o'clock. Subscription 2*l.* 2s. per annum.

*Saint Pancras Literary and Scientific Institution*, Colosseum House, New Road.—Lectures on Tuesday evenings, at half-past eight o'clock. Subscription 4s. per quarter.

*Islington Literary and Scientific Society*, Lower Road, Islington.—Lectures on Thursday evenings, at eight o'clock. Subscription 1*l.* 1s. per annum.

*Kentish Town Mechanics' Institution*, 5, Winchester-place.—Lectures on Tuesday evenings, at half-past eight o'clock. Subscription 1s. 6d. per quarter.

*Eastern Literary and Scientific Institution*, 88, Hackney-road.—Lectures on Tuesday evenings, at half-past eight o'clock. Subscription 6s. per quarter.

*Poplar Institution*, East India Road.—Lectures on Tuesday evenings, at eight o'clock. Subscription 5s. per quarter.

*Eastern Athenæum*, Stepney-square.—Lectures on Wednesday evenings, at eight o'clock Subscription 1*l.* 1s. per annum.

*Bermondsey Mutual Instruction Society*, Great George-street.—Lectures on Thursday evenings, at half-past eight o'clock. Subscription 1s. 6d. per quarter.

*Mutual Instruction Society*, Great Tower-street.—Lectures on Monday evenings, at eight o'clock. Subscription 1s. per quarter.

*Working Man's Association, Gray's Inn Road.*—Lectures once a week. Subscription 1s. per quarter.

---

*London Mechanics' Institution.*—The usual Quarterly Meeting of this Institution was held on Wednesday evening, the 7th inst, in the Theatre, when the committee presented their customary report. From it we learn that the receipts of the quarter amounted to 444*l.* 6s. 5d., and the expenses to 232*l.* 13s. 4d; the total expenditure of the quarter had however amounted to 441*l.* 4s, several debts owing at the conclusion of the last quarter having been paid. The total number of single lecture tickets sold during the quarter has been 127. At the date of last report the number of members belonging to the institution was 1,088; and 46 students: the present number of members is 1,100: the number of students 106. The number of new members admitted during the quarter amount to 235. New students 75. We were much pleased to find that a Volume of the PENNY MECHANIC had been presented among the donations. After the report had been read and received, considerable discussion ensued respecting the manner in which the last anniversary conversazione had been conducted; and it was strongly recommended to the Committee, that in future they take measures to prevent the excessive crowding of the theatre and rooms of the institution, that took place on that occasion. At a subsequent period of the evening, however, a vote of thanks to the anniversary sub-committee was moved and carried. A motion was then submitted to the meeting that in future the female relations and friends of members, should be admitted "to the lectures, and allowed the use of the library, on payment of *five shillings* per quarter;" or to the "lectures alone for *three shillings* per quarter." Some little discussion took place on this motion, but it was ultimately carried by a large majority. In order to become a law of the institution, however, it is necessary that it should be agreed to at the next quarterly meeting also. Votes of thanks were then given to the committee—donors of books—gratuitous lecturers—and chairman, after which the meeting adjourned.

---

LECTURES DURING THE WEEK.

*Hall of Science*, Commercial Place, City Road.—Thursday, March 22, W. H. White, M. B. S., on Meteorology, at half-past eight.

*Tower-street Mutual Instruction Society*, 16, Great Tower-street.—March 19, Mr. Timms, on Domestic Economy.

*St. Pancras Literary and Scientific Institution*, Colosseum House, New Road.—Tuesday, March 20, on Electricity.

---

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—Can any of your readers inform me where to get the cheapest and best work on Electrical Experiments, and at what price?

Also, can "Georgius" or any other of your Correspondents inform me how to make the conductor to the 'electrical machine" mentioned in No. 48 of your valuable work? R. T. Y.

Sir,—Can any of your Readers inform me how I can make a chuck for turning ovals, or where I can buy one cheap.

Feb. 27, 1838. AN AMATEUR ENGINEER.

Sir,—I shall feel indebted to any of your readers who will answer the subjoined questions.—1st. What composition is used for laying gold on in ornamental writing.—2nd. Where can I buy leaf-gold cheapest and best. W. SYRETT.

Sir,—Can you inform me how I can make percussion powder? R. E.

[Our Correspondent had better purchase it at a chemists' shop, there is too much danger attending making it.]

Sir,—Can you inform me the use of the tin foil in the Leyden phial?

Also, how can I magnetize needles?

March 8, 1838. A TINMAN.

[Electricity communicated to glass does not spread beyond the spot where it is thrown, owing to the non-conducting quality of glass.—Electricity may be communicated to the whole surface of any glass, or to any given part of it, if it be covered with a metallic substance, as tin-foil. This is called coating the glass.]

[Needles can be magnetized by being brought in close contact with a magnet, or by electricity.]

Sir,—Having a small workshop about ten miles distant from the metropolitan or other gas works, and port-

Digitized by Google

able gas not proving efficient for the purpose required, it is anxiously anticipated that some of your Correspondents will favour me with such information as will enable me to make the above article on my premises. EGOMET.

[See Oil Gas, p. 178.]

Sir,—I shall feel obliged to any of your Readers, who can inform me of a cheap and effectual solvent for copal, to enable me to make a varnish of it I am aware that the essential oils of lavender and rosemary will do it, but when spirits of wine is added, the copal is apt to separate.—Also, the best *metal* or *alloy* for the collars of a turning lathe; and the title of any work or works on the construction of the lathe, and the art of turning in general.

South Wales, MECHANICUS.
March 6th, 1838.

Sir,—"J. F." would feel obliged if any of your readers could inform him how to insulate copper wire cheaply, or how to obtain insulated copper wire at a less price than six or eight shillings per pound.

J. F.

Sir,—Can any of your Readers inform me of the best method of polishing ivory after it is coloured?

E. B. W.

Sir,—Can any of your Readers inform me how I can polish shells. Also, how I can remove the fur which covers many of them, (mother o'pearl for instance).

March 6th. C. MANN.

Sir,—If Mr. "C. D. Thomas" would describe the peculiar construction of the battery of his electro magnetic machine, I should feel much obliged to him.

March 2. M. R. C. S. L.

Sir,—I should be obliged if you or any of your Correspondents would inform me the best method of constructing a small garden fountain, one for a piece of miniature scenery.

Feb. 26. GEO. WELLINGTON.

[See Penny Mechanic No. 69.]

Sir,—I should feel greatly obliged by any of your Correspondents informing me how the rouge which jewellers use, for cleaning plate and jewellery is made. And also the powder for cleaning bronze urns, &c., such as is sold by ironmongers and others in boxes.

A SUBSCRIBER.

Sir,—Will any of your Readers inform me whether alcohol will chemically combine with any other substance?—Also, what is the cause of wet wood casting when dried.

## ANSWERS TO QUERIES.

*A cheap Green Colour for Rooms.*—Mix four pounds of Roman vitriol with one gallon of boiling water, when dissolved add two pounds of pearlash, stir the mixture till the effervescence ceases, then add a quarter of a pound of yellow arsenic. D. E. Q.

*Stars for Roman Candles.*—In a flat piece of wood as thick as the diameter of the bore of the case, holes are made by means of a stock and bit of the same diameter, into these holes introduce the star composition previously mixed up with gum-water. Now proceed to make the holes, which must not be made through by the eighth of an inch, and must be made by a piece of wood in the shape of a countersink tapering to the bottom. The stars may be dried in an oven for quickness, which process being completed, they are ready for use. Three pounds of saltpetre, eleven ounces of sulphur, one ounce of antimony, three ounces of mealed gunpowder, or in like proportion.

*To join the Gores of Balloons.*—Have the gores all one size, take one and lay it on a smooth table or board; paste the offside, and cover it with another gore, using something soft to press the seams together; now turn the pasted sides towards you, and fold back the uppermost side, and you have a side in the right position for pasting, which being done, take a gore as in the first instance and join it; turn this joint under, and another side presents itself. This is my method, and by it I can join eight gores, six feet long, in less than fifteen minutes. FRED. CLARK.

"An Amateur Die Sinker."—Get a thin piece of sheet-iron and bend it round the size of the face of the die, so as to fit tight on; then get some burnt leather, which must be well ground, and fill the hoop with it; then load with ashes, and it is ready for hardening. C. E. W.

Sir,—"Glaucus," will find his first Query answered in Number 72 of the Penny Mechanic.—2nd. Hydrogen gas is best made in a glass vessel such as is shown in Number 51, where he will also find a description of an economical gasometer.—3rd. Common lime is all that is used in the oxy-hydrogen microscope.—4th. There is no danger in making hydrogen provided all lights be kept away from the apparatus in which it is formed. H. L. N.

*To the Editor of the Penny Mechanic.*

Sir,—The accidents that have lately, and are always likely to occur on rail-roads, may be in a great measure rendered harmless by the introduction, (after the engine and tender) of three or four pairs of rail-road carriage wheels, connected at distant intervals, by rods of iron working in swivels, so that when any obstruction offers itself on the rails although the engine and tender may be thrown off, the carriages by the action of the wheels and swivels might continue undisturbed. My communication is short, but perhaps if you insert it and send a copy to each of the head conductors connected with the various lines it may be useful.

I am, Sir, Yours, &c
Feb. 23. G. D. D.

## TO CORRESPONDENTS.

*In consequence of the heavy press of Correspondence, and likewise at the request of several of our Readers, we have deemed it advisable thus early to publish another double Number.*

*We have received the Biographical Sketches sent by* Tyro Lock, *for which we thank him. The articles mentioned by our Correspondent would no doubt be acceptable, if they could be stripped of that abstruseness which generally accompany such subjects, so as to make them interesting to the generality of our Readers.*

H. M. Thomas's *answer to* O. P. Q.'s *question has been received.*

Received J. Thompson, jun. — A Subscriber, and Jeam E[illegible]g, &c.

*We feel obliged to* R. C. S. L. *for the hints he has given us*

A Young Chemist. *We wish to devote as great a portion of our Magazine as we conveniently can, to the communications of our subscribers.*

*Perhaps it would be better if Mr. Thomas were to send us his drawing; he can then place the references himself.*—[See No. 18.]

W. Hotine's *shoemaker's rounding-knife, or plough, is a very ingenious contrivance; and if the paring-horn can be made to travel true round the welt, and at the same time press the latter and the sole well together, no doubt it will be of great benefit to the craft. It shall be inserted with the Engraving. Respecting the latter part of his letter, we can only offer him the same privilege that* Mr. Mathews *has taken advantage of in our Journal, that of appealing to the public.*

ERRATA.—Number 69, p. 228, prop. 3; read thus: "The effective pressure in any position of the crank, is to maximum, as sine of crank's angle with perpendicular (from piston) to radius of circle described by crank," &c.

London: Printed at the Holloway Press, by D A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,

## AND THE CHEMIST.

No. LXXVI.] MARCH 24, 1838. [Vol II.

### HOTINE'S SHOEMAKERS' ROUNDING KNIFE.

FIG. I.

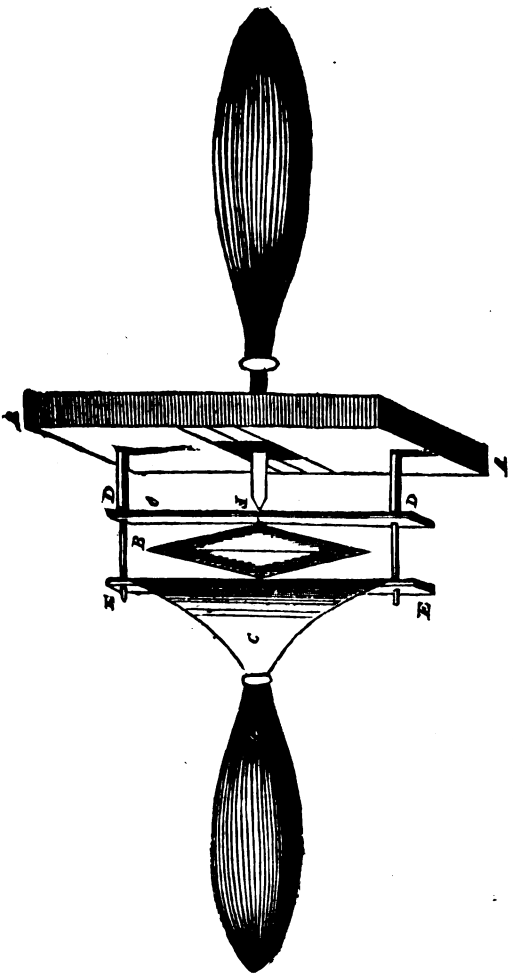
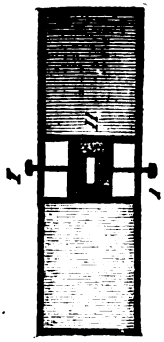


FIG. II.

FIG. III.



Vol. II.—No. LXXVI. Holloway Press: D. A. Doudney.

Digitized by Google

## SHOEMAKER'S ROUNDING KNIFE.

*To the Editor of the* PENNY MECHANIC.

SIR,—As your valuable journal is devoted to the improvement of the arts in general, and you have shown yourself willing to publish the suggestions of amateurs, I am induced to send you the particulars of a small machine, calculated to facilitate the labour of a certain portion of the community, viz., shoemakers. The utility of this instrument consists in its capability of performing that part of the work termed rounding, with greater accuracy and speed than it can be done by the hand. It is more especially useful to those who do not possess a good command of the knife, as it entirely precludes the possibility of cutting the shoe by a slip of the latter; for the information of those of your readers who do not understand the term rounding, I will state it is the technical term for paring the edges of the soles, an operation that requires considerable skill, as it determines the beauty and shape of the shoe. A A, Fig. 1, is a frame of wood bound with brass, as Fig. 2; B is a wheel in the form of a double cone, made of horn or box; it is fixed on an axis and revolves between the two cross pieces C C; D D are two arms fastened to the frame by nuts on the opposite side, and upon which the cross pieces are fixed by the nuts E E; F is the knife fixed in a handle and detachable from the machine, as fig. 3; and G is another handle fixed on the cross piece C. Fig. 2, shows the frame separate: H is a piece of brass sliding in grooves in the frame, and I I are two screws acting upon it at top and bottom, by which it can be raised or depressed to any height within the width of the frame; the orifice in the sliding piece of brass is to receive the blade, which must fit it sufficiently tight to prevent its moving laterally. The diameter of the wheel should be equal to the depth of the frame. The method of using this instrument is as follows:—First place the knife in the slide, then take the instrument, by holding the knife-handle in the right hand, and the other in the left, and place the wheel between the welt and upper; then by means of the screws that act upon the slide, fix the point of the knife at the proper distance above the edge of the wheel, according to the quantity of leather required to be cut off, then when the point of the knife is brought in contact with the leather, draw the instrument backwards and forwards, and the wheel will revolve in the channel formed by the welt, and being thin at the edge, will travel at the lowest point, and adapt itself to the various curves it may meet round the toe, &c. As the machine reciprocates, the knife may be thrust closer to the wheel every time it is drawn either backward or forward, for the point of the knife being similar to a lancet, it will cut both ways. By giving the instrument the proper inclination, of course any degree of under cut may be given, and if kept level during the operation, the result will be a smooth even edge, devoid of all those lumps occasioned by the jagging of a common knife.

W. HOTINE.

[We would advise our Correspondent to prepare a model of the above machine, and place it in some noted grinder's shop in the metropolis for inspection. Should it then be approved of by the trade, it may be of some benefit to him.]

---

*Joyce's Patent Stove.*—The fuel employed for the stove is stated to be vegetable charcoal that has been soaked in an alkaline solution for some time, and afterwards dried. It is said that this preparation of the charcoal prevents the formation of carbonic acid, or rather prevents its escape from the stove, the alkali combining with it; and hence the danger that ordinarily attends the combustion of charcoal is avoided. It is not known what alkali is employed.

*America.*—Mr. Warden communicates some recent events which have taken place in America, to the French Academy of Sciences; which are,—1st. An earthquake on the 18th and 19th of October, which has almost entirely destroyed Acapulco. 2nd. The discovery, in the province of Truxillo, of a town buried in the earth, probably in consequence of some great volcanic irruption. The natives do not possess any tradition of this fact, which seems to date at a period bordering on that of the establishment of the Spaniards in the country. 3rd. The existence of a considerable stratum of white statuary marble, discovered by Mr. Featherstonhaugh, in a chain of mountains in the Cherokee country. 4th. On the progress of the canal which is to unite the Atlantic with the Pacific. The cholera, which caused great mortality at Nicaragua, has caused a short interruption to the continuance of this enterprise, says this gentleman; but we know, from good authority, that there is nothing yet done which deserves to be called progress.—*Athenæum.*

Digitized by Google

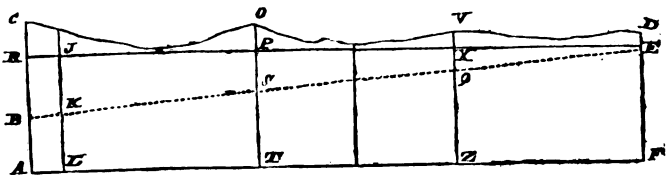
## ON LEVELLING.

NO. V.

Sir,—In the last I gave generally the rules for computing the inclines, and there hinted their utility in tending to elucidate ensuing articles, which we now proceed to exhibit, by investigating rules for finding the "averages." When the position of the new surface and its inclines, &c., are determined, the next step is to find the different heights or depths of the orighal surface of the country, above or below the surface of the proposed new road, and the average of these is technically called, the Averages.

In the diagram, let C O V D be the original surface of the country through which the line of railway, &c. passes, and B K S Q E the surface of the proposed new road; draw the dotted line B E parallel to the base A E, then the question is to find the heights C B, H K, O S, D E, &c., which is evidently to find the depth of earth above the new road, to the respective distances E Z, K T, E A, &c.

In this example, for the sake of simplicity, we have chosen the surface B E of the new road to be *below* the original surface, though it is very evident that we might have drawn it *above*, or both above and below at the same time; but the former




is the least complex, for which reason we prefer it, though any of them would answer our purpose equally well. For the given data we have all the different heights, C A, O T, V Z, D F, taken by observation, and in the last we have shown how to find the inclination on the whole, and also the rise per foot, whence evidently knowing the last we can readily find the inclination for any number of feet, and the question is now reduced to finding the heights A B, K L, Q Z, E F, &c., for evidently these heights substracted from the total heights will leave the heights above the new road required. And for this purpose, if we multiply the known heights F Z, F T, &c., by the incline per foot, we get directly the different heights X Q, P S, R B' &c., which the road has fallen by reason of its inclination from the first height E F, as indicated and proved by the dotted line; then deducting these heights from the first height E F, we get the heights Q Z, S T, B A., &c.,; then deducting these from their corresponding observed heights D E, V Z, C A, &c., we get directly the required depths V Q, O S, C B, &c., of the new road below the original surface, which are the depths of the cuttings to the respective points and distances E Z, E T, E A, &c.

Then the average of these will give the average depth of cutting or embankment, as the case may be, for it clearly applies to either, and it is quite immaterial whether we begin to compute the inclines from the end E F or B A; in the former case they are all falls, and must be subtracted, whilst in the latter they all rise, and must consequently be added to the respective heights E F, and B A. These few remarks will render the rule sufficiently intelligible to ordinary readers, the demonstration is founded upon too simple and obvious principles to be easily mistaken; this rule is the most tedious rule of all that are used in reducing levelling observations, more especially when the rise per foot happens to be a long decimal, which in actual practice is mostly the case; then the operations are extremely difficult, and unless great care is taken errors frequently make their appearance, not so much from the difficulty of the rule itself, but from the length and number of reductions to which it has to be applied.

To save all this trouble, most engineers draw their sections as accurately as possible, and compute by the scale, which is much more expeditious; for it saves the trouble of finding the inclines, and is sufficiently accurate if the scale is carefully applied. The rule may be verbally expressed as under:—Rule, find the inclination on the whole, and also the rise per foot by the rules already given, then to find the rise or fall for any given length (F Z); multiply it by the rise per foot, and it will be the rise or fall corresponding to this distance. Subtract this from the total height (F F) of the end of the road from which the reduction commences if it falls, and add if it rises, and it will give the height of the road (Q Z) to the distance (F Z), then subtract this last quantity

Digitized by Google

from the total depth (v z) at the same distance, and it will give the depth of cutting or embankment above the surface of the new road, continue this on consecutively till they are all obtained, then add them together and divide by the number of them, and the result will be the average depth required. There are two or three other ways of applying and demonstrating this rule, but the above is the most direct, and least complex, and the rule that is mostly used; it is perfectly free from all inverse reductions, and there cannot be any difficulty in understanding and applying it.

And to render everything as simple, clear, and explicit as possible, we will give an example by way of illustration; therefore let the base be 1200 feet long, A B and E F respectively equal to 10 and 40, and the height v z = 50, then by the previous rules we have,

E F — A B = 40 — 10 = 30, reduced to base line.

Then by page 99, 30 : 1200 :: 1 : 40, or the rise is 1 foot in forty; and by the same the rise per foot will be 40 : 1 :: 1 : $\frac{1}{40}$ Now let F Z = 120 to find the corresponding fall by the rule just investigated, we have $120 \times \frac{1}{40} = \frac{120}{40} = 3$, then to find Q Z we have 40 — 3 = 37 = Q Z; and finally by the rule V Q = V Z — Q Z = 50 — 37 = 13. And by similarly proceeding with every distance we get all the heights, let A A′ A″ A‴ &c. be these heights, and N their number, then $\frac{A + A' + A'' + A'''}{N}$ = the required average. When this average is ascertained, we have every data required for finding the areas of the transverse sections, &c., which will be the subject of the next paper. TYRO LOCK.

## ON THE NATURE AND PROPERTIES OF STEAM.

### NO. VIII.

### VIS VAPORIS.

THE proportions which the various parts of the steam-engine should bear to one another, have been a source of inquiry, which has occupied many of our first-rate engineers, and although the proportions given differ in many particulars, yet generally they agree in the main points. As a general rule, the length of the cylinder should be twice its diameter. and according to some, the length of the working beam in beam-engines should be four, but according to others, only three times the length of the cylinder; and on the authority of Tredgold, the velocity of the piston feet per minute should be 98 times the root of the length of stroke in pumping engines, and 103 the square root of the length of stroke in those engines applied to drive machinery; and the area of a transverse section of the steam passages should be the 4800th part of the product of the velocity of the piston in feet per minute, and the area in feet of a section of the cylinder parallel to its base. And if in the common atmospheric engine, the area so obtained be multiplied by half the volocity, the product by 1·23+1·4 divided by the diameter, the second product ÷ by 1480 will give the number of cubic feet required for steam per minute; and if the difference between 1220° and the temperature of condensation, be ÷ by the difference between that temperature and the temperature of the cold injection water, the quotient will give the number of times the injection water must exceed in quantity the water required to form the steam, generally about twelve times; and the aperture of the injection-pipe must be such as to admit that quantity to the condenser during the stroke. The head of water must be about three times the height of the cylinder, and the jet aperture if square, should be the 850th part of the area of the section of the cylinder parallel to its base.

In the atmospheric engine, with a separate condenser, the air-pump should be about 1-14th of the capacity of the cylinder, say stroke ½ engine stroke, and diameter ⅔ of the cylinder diameter. Let the area of the cylinder be multiplied by ½ the velocity, add 1-5th part for loss incurred to the product, ÷ by 1480, and the quotient will be the cubic feet of water required by the boiler for conversion into steam, and 24 times this quantity is required for injection. The orifice of the injection-pipe should be 1-36th part of the diameter of the cylinder. In the single-acting engine, the capacity of the air-pump and condenser should be ½ of the cylinder, or the diameter should be half, and the stroke that of the cylinder. The injection must be 24 times the quantity used for the production of the steam, and the injection orifice 1-31 of the diameter of the cylinder. In the double-acting engine, the proportions are the same as in the single; as regards the air-pump condenser and cylinder, the quantity of water required for steam and injection double, but proportion of injection orifice and cylinder the same. Bolton and Watt usually allowed 25 square feet of space in the boiler per horse. The common proportions are, width 1, depth 1·1, and length 2½. C. D. T.

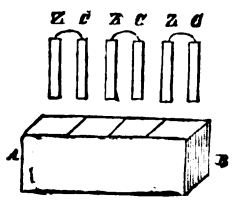
Digitized by Google

# THE CHEMIST.

## GALVANISM.

Several improvements have been made in the pile, the most important of which was the discovery of Cruickshanks. The apparatus used by him consists of a wooden trough fig. 1, A B, in the nobs of which are cut grooves at the distance of a quarter or half an inch from each other, according to its size, and into which are placed plates of copper and zinc, c z, soldered together, following the same arrangement as in the construction of the pile, copper zinc, copper zinc, &c.; so that in looking from one

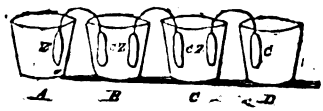
Fig. 1.




end, B, along the battery, we observe all the zinc faces, and from the other, A, all the copper ones. Different liquids are used for the excitation of galvanism; when water is employed the effect is trifling; solutions of the compound salts produce more effect, but those by which the greatest action is excited are the acids, and of these nitric is preferred. It is generally diluted with about 20 or 30 parts of water; instead of this, muriatic acid, with sixteen parts of water, may be used for the same purpose; a mixture of nitrous and sulphuric acid is employed. Mr. Children recommends a mixture of 3 of nitrous and 1 of sulphuric diluted with 30 parts of water. When we wish the galvanism to be strong, we rather use a large battery than increase the strength of the acid, because in the latter case it acts powerfully on the plates, and destroys them; and as it would be inconvenient to have a great many plates into one trough, several small troughs are used, the adjoining ends being connected by wire, taking care that a zinc termination is always opposed to a copper one.

Instead of the arrangement already described, it has been found that galvanism may also be excited by filling a number of glasses (fig. 2, A B C D) with diluted acid, and placing into each a plate of zinc and copper, z c, not in contact, but connecting the adjoining pieces of the different vessels by wire, following the same arrangement throughout of zinc, copper, zinc, copper, &c., the zinc of one vessel being joined to the copper of the adjacent one. This ap-

Fig. 2.




paratus was proposed by Volta, and called by him couronne de tasses. Though not so easily managed as the common trough, yet, owing to both sides of the metal being exposed to the acid, the action on the acid is more powerful. The form in which it is now used, is a wooden trough with glass partitions, or an earthenware one (fig. 1, A B) divided into compartments into which the acid is poured, and the plates, z c, joined by a cross bar at top, are inserted so that the copper of one pair and the zinc of another are in the same compartment.

These plates are easily removed and cleaned, and for this purpose they are generally suspended from cross beams, and put into the acid when required.

J. R. Watts, M. D.

## COMBUSTION.

*To the Editor of the Penny Mechanic.*

Sir,—A correspondent, in No. 72, is of opinion, that a poker laid over the fire will make it burn; I thank him for his contribution, although I cannot admit the truth of his reasoning. Trifling as this subject may appear, it ought not, I think, to be dismissed until its truth or error is satisfactorily established. I have very little doubt upon the subject myself, but there are others who even go so far as to say, that they think the fact is established beyond the possibility of a doubt. Mr. "Vand." &c., says that plants excluded from the light are unhealthy, and that scarlet beans run up sticks and strings; this is unquestionably true, and he might add that Mahomet, mounted on a white donkey, ran up a ladder of light (so at least the Turks are bound to believe, under a penalty too awful to mention), but by a singular oversight, your correspondent has omitted to state by what process of reasoning he concludes from these facts, that the aforesaid poker will make the fire burn; and no logic of mine will supply the defect. Again, "if the hand be placed over a candle whilst burning, it shoots up towards the hand." This is

Digitized by Google

more plausible in appearance, but equally inapplicable in reality; if you retard the ascending current of air, you diminish the supply of oxygen, and thereby *retard* the burning of the tallow, so the gas is allowed to proceed further up the wick before it is consumed. Such, at least, is the explanation which occurs to me at the moment, though I have not given the subject much consideration; but if the thing can be done, why not make the experiment on the fire itself? I have tried it without success, and until I see it done, I must beg to be excused for believing my own senses in preference to hop poles and scarlet runners. I am aware that very many persons entertain the same opinion as Mr. V. I am acquainted with a gentleman, for whose judgment I have the utmost regard, and yet he is also of that opinion; but when Mr. V. presumes that there is not another person in Great Britain besides myself who ever doubted the circumstance, I must say his notion of "every body" is most exorbitant; the every body" to whom I alluded, was the one who a few weeks ago petitioned Parliament for the dismemberment of this empire, and who is now scrambling for Murphy's almanac. If "every body," who thinks with your correspondent, were to be assembled together, my opinion is, that there would be a greater congregation of old women than was ever before witnessed.

I remain yours, &c.

Q. E. D.

## COMBUSTION AND EXPLOSION.

1. Bruise, and slightly moisten with water, a few crystals of nitrate of copper; then roll them up quickly in a piece of tin-foil: in about a minute the tin-foil will begin to smoke, and soon after take fire and explode with a slight cracking noise.

2. Throw a few grains of chlorate of potash (oxymuriate of potass), and a very small bit or two of phosphorus, into a cup containing a little sulphuric acid, the phosphorus will instantly burst into a flame.

3. Take five parts of nitrate of potass (saltpetre), three of sub-carbonate of potass (salt of tartar), and one of sulphur, all quite dry, and mix them together in a warm mortar; if a little of this powder be placed upon a shovel, over a hot fire, it first begins to blacken, and at last melts and explodes with a loud report. A small quantity only should be used; for although there is no danger in the mixture, yet some nervous persons may be alarmed at the loudness of the report.

4. Put a small quantity of calcined or pure magnesia into a cup, and pour over it a sufficient quantity of sulphuric acid to cover it; almost immediately combustion will commence, and sparks will be thrown out in all directions.

5. Pour a table spoonfull of oil of turpentine into a cup, and place it in the open air, then put about half the quantity of nitric acid, mixed with a few drops of sulphuric, into a phial; fastened to the end of a long stick, pour it upon the oil, and it will immediately burst into flames, and continue to give out much light and heat.

6. Rub a few grains of chlorate of potash, and about half the quantity of sulphur, together in a mortar, and a cracking detonation will be produced, accompanied with flashes of light. If a small quantity of the same mixture be wrapped in paper, laid upon an anvil, and smartly struck with a hammer, a report will be produced, which will be loud in proportion to the quantity used.

7. Take a little of the composition mentioned in the last experiment on the point of a knife, and drop it into a wine glass containing sulphuric acid; a beautiful column of flame will be the consequence immediately it comes in contact with the acid.

8. Mix a few grains of chlorate of potass with twice their quantity of loaf sugar reduced to powder; place this mixture upon a plate, dip a piece of wire in sulphuric acid, and let a single drop fall from its end upon the mixture; it will immediately burst into flame, and continue to burn till the whole is consumed

9. Take a metal button, and rub it a short time against a piece of wood or stone, then touch a small piece of phosphorus with it; the latter will immediately fire and burn.

10. Hold the end of a rod of glass to a grindstone while it is revolving; in a very short time it will become so hot, that phosphorus, gunpowder, and other combustible bodies, may be inflamed by it. Wood rubbed against wood will also produce great heat; the natives of New Holland light their fires by these means.

11. *Combustion by concentrating the Sun's rays.*—Hold a double convex glass of about two inches diameter, to the sun about mid day, when shining very bright, at its focal distance from a piece of corn, which will soon become so hot that it cannot be touched with the finger. The intensity of the heat produced will depend

Digitized by Google

upon the size and convexity of the glass, and also on the season of the year. Gunpowder, phosphorus, &c., may be set on fire in this manner, and with a very powerful glass most of the metals may be melted.

12. Put a small piece of German tinder into the lower end of a syringe, then draw up the piston and force it suddenly down by giving it a smart touch against a wall or table, when the tinder will be ignited, either from the sudden condensation of the air, or the friction occasioned by the movement of the piston. Syringes for this purpose are sold in London at about half a guinea each.

13. Take two pieces of bonnet cane, and rub them strongly against each other in the dark, and a considerable quantity of light will be produced. Two pieces of borax have the same property in a more eminent degree. In this and the other experiments, the effects described being produced by friction, they ought, in strict propriety, perhaps, to be called electrical rather than chemical experiments.

14. Put a small quantity of spirits of wine into a glass with a halfpenny or a shilling, then direct the rays of the sun, by means of a glass, upon the coin, and in a short time it will become so hot as to inflame the spirits.

E. GODDARD.

## ON MULLINS' BATTERY.

*To the Editor of the Penny Mechanic.*

SIR,—Perceiving in No. 72 of the Penny Mechanic, that Mr. Coombe has given a description of Mullins' modification of Daniell's battery, I may perhaps be allowed to communicate to your readers the fact, that a scroll of brown, and, I presume, any other paper joined by sealing-wax up the side, and having one of its ends doubled over on itself and well waxed, will answer all the purposes of the bladder described by Mr. Coombe, as a partition between the fluids. In making this assertion I speak from facts, having, by the occasional addition of a few crystals, kept a battery of this kind in action four days, driving a rotary electro magnet nearly all the time, and using for my partition the brown paper above alluded to; and I find, on taking out the cylinders, that the paper seems as strong as at first. I think I may say, that it has advantages over the bladder, at least it has so over bladders that are not straight, inasmuch as there is no bulge or belly to it, which belly is a great inconvenience in common bladders, they often coming in contact with the zinc, whereas the paper, by being formed into a cylinder, is kept equidistant from the zinc and copper from top to bottom of the pot; and another advantage to those who are rather too nice to make good experimentalists is, that it is more cleanly, because, when the action of the battery has ceased, it may be thrown away with refuse liquor, and a new one substituted, when the battery will again be ready to receive its fluids. If the above is deemed worthy of insertion, it may interest some of your readers.

I am, Sir, yours, &c. J. F.

Page-street, Westminster, March 10.

*To the Editor of the Penny Mechanic.*

Sir,—I have taken the liberty of sending you another process for the preparation of potassium, which is much easier and more economical than that recommended by Dr. Watts, which is an extremely difficult and expensive process. All the apparatus required in my operation, is an iron bottle, such as is used for making oxygen, holding about a pint, with a piece of iron tube or a gun barrel, screwed into the mouth. The tube is to be bent into this form (*f*). The retort being charged and luted, is to be placed in the fire, so as to allow the long leg of the tube to pass perpendicularly down in front, and the end is to be placed in a vessel of naphtha, with a tube for the purpose of carrying off the gas, which is given off in immense quantities. The receiver is to be placed in cold water or ice. The retort is to be charged with four ounces of fused potass, mixed with six ounces of iron turnings and an ounce of powdered charcoal, and to be covered over with two ounces more of iron turnings; the tube is then to be adjusted, and the distillation proceeded with. From four ounces of potassa I have obtained by this method about 100 grains of potassium. A red heat is sufficient, and u sed sub-carbonate of potass may be used.

H. L. N.

## INSTITUTIONS.

*Society for Promoting Practical Design*, and Diffusing a Knowledge and Love of the Arts among the People, St. Martin's-street, Pall-mall East. On Tuesday the 13th instant, the first lecture of this institution was delivered by James Elmes, Esq., to a highly respectable audience of ladies, gentlemen, and mechanics; William Ewart, Esq., in the chair. In an address of deep literary research, Mr. Elmes entered into a consideration of the connection and comparison of literature, science, and the fine arts; he alluded particularly to the mathematics as a connecting link between the several branches of knowledge, furnishing alike the reasonings of the philosopher, the arguments of the orator, the composition of the artist, the monument of the architect, and the railroad of the engineer. After the lecture, the chairman addressed the meeting on this and other practical results of the Parliamentary Committee, of which he was the chairman. He likewise, informed the meeting, that a branch society had been established in Manchester, and that similar societies were being formed in other populous towns throughout the United Kingdom. There were upwards of 200 persons present.

*Mutual Instruction Society*, 73, Rahere-street, Goswell-road.—This Society, which was established in December, 1834, and confined to carpenters and joiners only, was opened to the working classes in general on the 1st instant, and is going on prosperously. They have a library of about 200 volumes &c.; and a lecture is delivered every Wednesday evening at eight o'clock. There are also evening classes for drawing, modelling, The payment of members is 1*s.* 6*d.*, and pupils 2*s.* 6*d.* per quarter

Digitized by Google

## LECTURES DURING THE WEEK, ETC.

*Mutual Instruction Society*, Great Tower-street.—March 19, Mr. Timms, on Domestic Economy, at half past eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, Mr. Dalton, on the Properties of Matter, at half-past eight o'clock.

*Hall of Science*, Commercial Place, City Road.—Thursday, March 20, W. H. White, M. B. S., on Meteorology, at half-past eight.

*Botanical Society*, 75, Newman-street, Oxford-street. Friday, March 26th, D. Cooper, esq., on Botany, —*Roots*, at seven p.m.

*St. Pancras Literary and Scientific Institution*, Colosseum House, New-road.—Tuesday, March 27th, Mr. Braithwaite, on the Principles of Machinery.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, March 28, J. Wallis, Esq., on Astronomy; Friday, March 30, J. Wallis, Esq., in continuation, at half-past eight o'clock.

*Aldersgate-street Institution*—Wednesday, March 28, J. S. Knowles, Esq., on the Greek Drama, at eight o'clock.

*Poplar Institution*, East India Road.—Tuesday March 27, Mr. Wyld, on Physical Geography; Thursday, March 19, a Conversazione.

*Islington Literary and Scientific Society.*—Thursday, March 20, Dr. Matthew Trueman, on Comparative Physiology, at eight o'clock.

*Westminster Mechanics' Institution*, 5, Little Smith-street, Thursday, March 20, Dr. Birkbeck on the Structure and Preservation of Vegetable Bodies, at half-past eight o'clock.

*Tower-street Mutual Instruction Society.*—Monday, March 26, Quarterly Meeting, at eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, March 27, an Essay, at half-past eight o'clock.

## QUERIES.

Sir,—I shall feel greatly obliged if any of your readers can inform me how to prepare refined and colourless ox gall, such as artists use in working water-colours on gold, and which prevents the colours from running when laid on the gold? Or if you could inform me of any other preparation to answer the same purpose, as I have occasion to use a great deal of it? and to purchase it at the colourman's, it comes too expensive for my purpose: they charge 1*s.* 6*d.* for a bottle only two inches long. My present mode is to mix the colour with gold size; but the above would answer better if had on a cheaper scale. J. O. W.

Sir,—Can any of your Correspondents inform me the method of japanning small iron articles, to look like the coal scuttles, &c., that are japanned.

W. P. C.

A "Subscriber" would feel obliged to any of your Correspondents who can inform him how the black varnish is put on the patent leather now so much used.

Sir,—Can any of your readers inform me of the process for colouring the wire-gauze blinds, and how the colour is prepared? H. T.

Sir,—Will any of your readers inform me of the construction of the slide valves necessary to reverse the motion of a locomotive engine? I have never yet read a description of it in any treatise on the subject. A. T.

Sir,—Is there any place where steel or iron pipes for constructing small models of machinery may be purchased, and are they very expensive?—Also, has any further information relating to Davenport's electro-magnetic engine transpired.

[We understand that Mr. Davenport is now constructing an electro-magnetic engine in America, which is intended to drive a Napier printing-machine, so that it will shortly be put to the test.]

"W. C. C." How can I make magnets?—See No. 62.

## ANSWER TO QUERY.

In reply to one of your queries, "*Where can flexible tubing be procured?*" I beg leave to say, it can be procured of any length, from one-eighth of an inch to three inches diameter, at E. Harris's, Lowther Arcade, also at the patentees, Macintosh and Co., 46, Cheapside, and 58, Charing-cross.

W. P. C.

## TO CORRESPONDENTS.

W. T. *on Timber Measuring shortly.*

C. C. W. *We cannot promise to give insertion to his paper on gas.*

*The Watch Alarum of* Timothy *has been received. We have already given so many, that we cannot promise its insertion.*

*The paper on Chemistry, sent us by* J. Thompson, jun., *shall appear at the earliest opportunity.*

C. D. Thomas's *papers on Steam have been received.*

*The sketch of the Automatic Ship and Sea sent us by* Sciolisteros, *is deserving a place in our Magazine, and shall be attended to.*

*We shall be obliged to postpone the article on the Grinder's Asthma* (*sent us by* J. Gordred) *for a short time, in consequence of the press of Correspondence already by us.*

J. E. Goddard's *two papers on Combustion and Electricity, were received at our Office; but, by an oversight of ours, the receipt of them was not acknowledged at the time. We have this week received his plan for an improvement in the Floating Fire Engine, but we cannot promise its insertion so early as he requests.*

J. C., jun., *shall be noticed in our next.*

*We return our thanks to the numerous Subscribers who have acquiesced in our issuing Double Numbers. As our Correspondents are so numerous, and we wish to make this a journal of communication for the Working Classes, we shall have occasion, most likely, to issue Double Numbers frequently.*

A Young Engineer *shall be noticed when his diagrams are engraved.*

Q. E. D.'s *letter shall appear next week.*

Tyro Lock—*No.* 80 *will complete our second volume.—The paper on First Appearances shall appear in our double Numbers.*

S. Walter's *Improvement on the Paddle-wheel shall be noticed in its turn. We cannot give him any advice on his Perpetual Motion.*

*The article sent us by a* Regular Subscriber *is an Advertisement. He had better advertise in our Monthly Wrapper.*

Received F.—Frederick Persent—Glaucus.—Sigma's Answers to K. V. Croft and W. U.; the first will be inserted when the diagram is ready.—E. D. W.

ERRATA.—"Crank Analysis," page 256, line 18, for "no proportional loss," read *a proportional loss*; and page 267, line 21 from bottom, for "$B = \frac{B \times C''}{L}$ read $\phi = \frac{B \times C}{L}$."—"Levelling," page 268, line 26 from bottom, for "62" read 82.—Lardner's Lecture line 13 from top, for "strikes" read *strokes*.

London: Printed at the Holloway Press, by D. A. Doudney; where all Communications are to be addressed (post paid); published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,

## AND THE CHEMIST.

No. LXXVII.] MARCH 31, 1838. [Vol II.

### DR. SCOTT'S HEARING CORNETS.

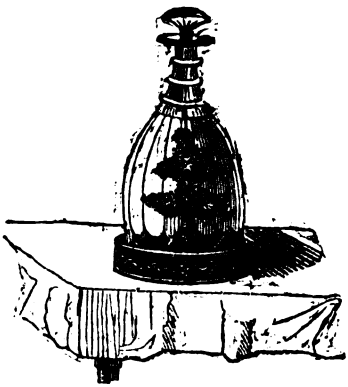
THE BUGLE CORNET.

THE SCROLL CORNET.

THE BUGLE CORNET.

### THE LEAD TREE.

FIG. IV.



Vol. II.—No. LXXVII. Holloway Press: D. A. Doudney.

Digitized by Google

## THE VOICE CONDUCTOR, OR HEARING CORNETS FOR DEAFNESS.

INVENTED BY JAMES SCOTT, M. D.

As a great portion of our Readers are attendants at the Theatres of Mechanics' Institutions, where lectures on various interesting and important subjects are continually being delivered; and as we are acquainted with several persons who would gladly embrace the opportunity of attending such lectures, were it not that they are afflicted with deafness,—we have no doubt but that many of our subscribers (not known to us) may be similarly afflicted. For this reason we have thought a description of Dr. Scott's Voice Conductor might be of service to those who are suffering under the above affliction; while those of our readers who, from their keen sense of hearing, have no occasion for the assistance of the aurist, will excuse us for introducing a subject which may seem unimportant to them.

The utility of the voice conductor has been acknowledged in every rank of society. It pours into the ears of the noble, the conversation which, but for its aid, would be lost in the vastness of the spacious saloon: and it gladdens the heart of the cottager when surrounded by his family, at his humble fire-side. In the intermediate grades of life, its assistance has been extensively called in—it is worn in the pulpit, on the bench, and at the bar; —in the general pursuits of life, it has been found highly useful in the office, counting-house, and shop; in public assemblies, whether of religion, amusement or business, it is resorted to with great satisfaction.

*Description of the Voice Conductors.*—The voice conductors are made in two shapes, which, from their figure, are called the Scroll and the Bugle. There is a large and small size of each kind; the large size of the scroll shape, is denominated the *expanded* Scroll: whilst to the large Bugle is given the name of the Double Power Cornet, because it conveys twice as much sound as the small bugle, and considerably more than the expanded scroll.

The small scrolls are three inches in depth and two inches wide, corresponding very nearly to the shape of the ear: but, notwithstanding their small size, they contain a tapered canal thirteen inches in length, through which the sound flows, and by which it is brought to a focus upon the drum of the ear. They are worn in pairs connected by a spring that passes over the top of the head, and are very conveniently worn under a cap, so as to admit of concealment—a man, also, may wear them with his hat on. The larger or expanded scrolls have a greater length of canal than the small scrolls; are an inch deeper; and the mouth, also, is nearly half an inch wider.

The small bugle cornet corresponds, in dimensions, with the small scrolls, but in reversed directions; the scroll having its greatest area perpendicularly—and the bugle, horizontally. The canal of the bugle is shorter than that of the scroll, but its embouchure being rather larger, the bugle is equal to the scroll in power. The only marked difference between the two is, that the bugles are more conveniently worn by gentlemen with their hats than the scrolls; whilst the scrolls admit of being concealed under a lady's cap rather more commodiously than the bugles.

The Double Power Bugle is 4½ inches in horizontal length, and two inches in depth: its mouth is 1½ inch in diameter. It may be worn by gentlemen as easily with the hat on, as the small bugle; but, although many ladies wear it under their caps and bonnets, it must be acknowledged that it is not quite so suitable;—it is very well adapted for being worn outside the cap (as shown in the plate) and is the most powerful of the voice conductors.

## "Q. E. D.'s" DEFENCE OF HIS SCIENTIFIC QUESTIONS.

*To the Editor of the Penny Mechanic.*

SIR,—I have now before me No. 70, of your Magazine, in which I find an *original* paper signed "Tyro Lock," (not *Locke*, by any means). The purport of those passages to which any distinct meaning can be attached, seems to be, to censure "Q. E. D." for proposing certain questions which do not come within "Tyro's" grasp. As your Correspondent would probably feel disappointed were I to leave his allegations unnoticed, I will analize his little satire as briefly as unequivocal confutation will allow; hoping that if I succeed in making him sensible of the absurdity and inexpediency of his undertaking, he will in future keep such objectionable productions in safe custody with the "wax and glass seal," in his pocket.

Some months ago, I mentioned a plan of collecting a number of scientific questions of progressive difficulty for the practice of students; and in order to make my meaning more clearly understood, I gave an example of twenty questions,

Digitized by Google

which I afterwards undertook to answer and explain; I have answered five or six of them, and the others will follow in order. Now it appears this "Tyro Lock" has been trying his skill upon these questions, not by the legitimate effort of his own reason, but as he states, by searching in books for the knowledge of others, although I said they were not intended as a test of erudition, but of intellect; so having been weighed in the scales, and found wanting, his wounded vanity oozes out in a tirade against the proposer of the questions. But let the gentleman speak for himself; we shall see what use he makes of his own rope: "In speaking of the questions by way of introduction, he (Q. E. D.) says, 'I do not consider any of them very difficult, and they all admit of positive and incontrovertible answers.' "Upon comparing this assertion with one or two of these questions, *I* am at a loss to find any definite answers. To be sure, perhaps *I* may be too thick-headed." This is perfectly candid and logical; he acknowledges his inability to answer the questions, and forms a very rational conjecture upon the cause of his failure; this single paragraph embodies the substance of all that can be inferred from his succeeding columns; but unfortunately, this little gleam of reason only serves by its contrast, to show in more prominent relief, the extravagant rodomontade, and the clumsy and indecorous attempts at satire which follow.

"Satire should like a razor keen,
Cut with an edge that's scarcely felt or seen."

Tyro's is an oyster knife; he informs us that "Q. E. D." is "foolish" and "opaque," and in order to attract especial attention to his meritorious discovery, he puts it in italics: now I will appeal to you Mr. Editor, whether you would like yourselves to be called a *fool* in *italics*, even by "Tyro Lock?" a great deal is sometimes implied by *italics;* suppose for instance, I were to say to "Tyro,"

"Quid me (***) stulta dente captas lœdere,
Omne adsueri ferrum quæ corrodere."

That would merely signify that "Tyro's" attack was injudicious, because he exposed himself to an inevitable and disastrous repulse; but if I were to say "Quid me *stulta*, &c.," I should declare "Tyro Lock" to be a *dunce*, which would be both uncivil, and unnecessary. It will however shortly appear in plain roman letters, that the whole amount of folly upon which he expatiates, must inevitably be added to his own stock. The question of which he chiefly complains, is this, "It is stated in a foolish work recently published, that 'if there were no atmosphere, a person turning his back to the sun, would be in total darkness:' prove this to be false." I found this erroneous assertion in a magazine; the article in which it occurred, was given as an extract from a work entitled "Joyce's Scientific Dialogues." I did not condemn that work because it contained this one false proposition, but because I found the several articles which I read, to abound with absurdity, which would have shocked any sensible man, even in that age of darkness which preceeded modern civilization. One example will, I think, be sufficient to justify all I have said upon the subject: Speaking of the fixed stars, a tutor (not a Tyro) is made to say that the several stars which appear to us to compose a constellation, are in reality, only one star refracted into different apparent places by the atmosphere, which he says is cut in angles like those lenses called multiplying glasses. In order to exemplify this proposition, he produced a glass cut into angular faces, similar to those which he supposes to exist in the atmosphere; a half-crown is then placed upon the table, and viewed through this glass, it does indeed appear like a great number of pieces; so the proposition is demonstrated, and the "Tyro's" admire the sagacity of their tutor. Grosser absurdity than this is not to be found either in the fool's almanack, or in the night-mare of "Tyro Lock." I shall perhaps be told that eminent men are concerned in this work; and what then? why more shame for them, since they have neglected their opportunity of obtaining better information. I believe this book has also some pretentions to popularity—so have many bad books, and bad men too; and this only confirms an opinion I have long entertained, and which was expressed by Molière above a hundred years ago, when the present inhabitants of the earth existed only in the mysterious and inscrutable programme of nature:—

"De Paris au Perou, de Pekin à Rome,
Le plus sot animal, à mon avis, c'est l'homme."

It was not my intention to comment upon this work; my only motive for qualifying it, as I have done, was to let the reader know that I did not expect him to controvert any received doctrine, but merely to correct a palpable blunder in an inaccurate work. As for the answer to my question, it must be obvious to every one who has the slightest knowledge of optics, and will be seen in its turn. Now whatever may be the value of "Tyro Lock's"

Digitized by Google

assertion as a general proposition (viz. "that Q. E. D. is very foolish.") I contend that it cannot be fairly inferred from the fact against "Tyro" being ignorant of optics, and yet he arrives at that conclusion upon no other grounds; but let us give him a fair hearing; he quotes these words from Paley: "If I had the power of seeing only by means of your rays coming directly from your sun, whenever I turned my back upon your luminary, I should find myself in darkness;" or, in other words, *if I received only your direct rays, I should not receive your indirect ones.* This is certainly a very prudent and accurate, though not very edifying proposition. He then proceeds to say, that "this question is to be incontrovertibly controverted, which Q. E. D. promises to do." This is to all intents and purposes one of those things which I shall only designate by declaring, that the contrary is strictly true; so far am I from having promised to controvert this nonsense, that neither myself nor any other writer in this work except "Tyro Lock" himself, has alluded in any way to either Paley or his proposition. By way of palliating this aberration from reality, the example of Shelley is brought forward. We are informed that "*his* fertile genius led him beyond the bounds of truth," and his character is summed up in these words: "In fact he was sceptical—*so am I.*" Now whether "Tyro" is led beyond the bounds of truth by "a fertile genius," or whether his approach to it is impeded by a barren one, I shall not stop to examine; but that he has deviated widely from it, is unquestionable. The chief portion of the succeeding paragraphs is unintelligible; this much, however, may be collected: he cannot answer question 13, which requires some elementary knowledge of the laws of motion, and "Q. E. D." is of course called to account for "Tyro's" deficiency in this, as in other respects.

I now arrive at the last coil of "Tyro's" tænia; I give it verbatim from the *original*:—"In regard to Quest. 4, I have many observations to make which will interest all parties. The question, as there given, is rather imperfect; some dimensions of the quill should have been given." Now this is very unfortunate, as it is evident from his own words, that he does not understand this question, although it has been clearly and minutely explained. So far from its being necessary to give the diameter of the tube (the height *is* given), the whole drift of the problem is to show that the result is not affected by the size of the tube; it may be, as I proposed, the size of a common quill, or the whole diameter of the vessel. This gross misconception of the question is, I say, unfortunate; for any reasonable person not being aware that such errors are the consequence of a "fertile genius," would naturally ascribe so egregious a blunder to dense impenetrable stupidity; but even admitting the validity of his logic, from which we are to conclude that I am responsible for the obtuseness of his faculties, how, I ask, can he justify his threat of inflicting upon the public "many observations" upon a question which has already been fully and properly answered, and of the nature of which he in the same sentence proves himself utterly ignorant; and what name, I would ask, does he give to that sentiment which induces him to affirm that such proceedings will "interest all parties."

There is one assertion in "T. L.'s letter which, I confess, is not so easily invalidated; he says he knows something upon which "both Q. E. D. and himself are of the same opinion," but he does not state what it is; if *it* is not more rational than his observations upon practical mechanics, I must beg leave to differ from him even upon *it*; practical mechanics are made of the same materials as other people; and they are very often more desirous and more capable of acquiring information than mere gentlemen.

Believe me, "Tyro," you have made a *faux pas*; retrace your steps, for depend upon it, your fragrance will be inversely proportional to your stirring in this matter. I have purposely made this letter as unpalatable as a rigid adherence to the unerring standard of justice would admit; but *disparagement is not my object.* I hope your own sense of propriety, equity, and prudence, will suggest to you the right course you have now to pursue; viz., the total abandonment of your ill-directed vituperative system. If not, my advice will, I fear, be of little avail, this much, however, I will say, the very worst plan you could adopt, would be to attempt the salvation of the half consumed fragments which still remain amongst the smoking ruins of your fallen fabric; let it go; and be careful in future to select more substantial and less inflammable materials, if you desire to construct a useful and durable edifice. In conclusion, I regret to say, that your epistle in its whole texture, tendency, and intention, is impotent, unwise, and illiberal, and richly deserves the unmitigated censure I pass upon it.

Accept, Mr. Editor, the assurance of my respectful consideration. Q. E. D.

Digitized by Google

## ON THE NATURE AND PROPERTIES OF STEAM.

NO. IX.

VIS VAPORIS.

Owing to the uncondensed steam, to the force expended in its expulsion, and the friction of the valves and various other parts, and the power required to work the pumps, &c., considerable loss of motive force is occasioned; and in the common atmospheric engine, this loss has been estimated by Mr. Tredgold at ·49 of the atmospheric pressure, or very nearly ½, leaving .51 or 5.9 lbs. per circular inch as the effective pressure. In the atmospheric engine with a condenser, in which also (as compared also with the common atmospheric) extra force is expended to work the air-pump, the loss is only .458 of the atmospheric pressure ∴, the effective pressure is ·542, or 6¼ lbs. per circular inch. In the single-acting engine, the effective pressure is nearly 6½ lbs. per circular inch; and in the double-acting engine the effective pressure is 7·1 lbs. per circular inch; when the steam has a greater pressure than this, the effective pressure will of course be increased.

*To Calculate the Power of Steam Engines.—The Common Atmospheric.*—Square the diameter of the piston in inches, which will give the area of the piston in circular inches; and since 5·9 is the effective pressure in lbs. per circular inch, multiply the area of the piston by this number, and the product will be the effective pressure on the piston; and this multiplied by half the velocity of the piston in feet per minute, will give the effective power in lbs., raised one foot high per minute; and this divided by 33.000, the weight raised one foot high per minute by one horse, will give the horse power of the engine.—*Example.* Atmospheric engine cylinder 20 inches in diameter, and 40-inch stroke, velocity 220 feet per minute.

20×20=400
5·9 effective pressure per inch.
3600
2000
2360·0
110=½ the velocity.

38.000)259600.0(7⅞ nearly for No. of horses power.
231
28
33

In this manner can also be found the power of the *atmospheric engine with condenser*, and the *single-acting engine*, using, instead of 5.9, their respective effective pressures, as above, viz., 6¼ for the atmospheric with condenser, and 6½ for single-acting engine; and by multiplying by 7·1 and by the *whole* velocity instead of half, as in the previous cases, we can estimate the power of the *double-acting engine*. The whole velocity must be used in the double-acting, because both up and down stroke are productive of power, while in the atmospheric and single engines, only the down stroke is productive of power, hence half the velocity alone must be used.

## MECHANICS' LIBRARY.

*Mental Arithmetic.* By Anthony Peacock. London, Souter, Fleet-street.

This little volume contains a series of rules for calculating the cost and prices of various denominations of goods; and for resolving questions in interest, mensuration, natural philosophy, and other branches of science. Every person in business must be aware of the great benefit resulting from the attainment of mental calculation. With what rapidity do we sometimes see the shopmen of our grocers, linen drapers, &c., sum up the prices of the different articles which have been purchased! While the customer is either searching his pocket for his "ready reckoner," or counting his fingers, endeavouring to arrive at the sum total, the man of business has the articles packed up, the bill placed on the top of the parcel, and with the palms of his hands resting on the counter, staring the poor accountant out of countenance, politely inquires, "Is there anything else I can serve you with, madam?" The calculating customer is urged to put an end to the reckoning, by looking at the bill and paying the money. We have not room for more than a short extract or two, but at the same time recommend the book to our readers as a useful one.

"*Rule* 1.—The most obvious method of finding the value or cost of any number of articles is to multiply the price by the quantity, and to divide the cost by the quantity for finding the price of one."

"*Example* 1.—Required the value of 63 ounces at 4*d.* per ounce. Here 4*d.* is 1-3rd of 1*s.*: hence 1-3rd of 63 is 21*s.*, or 1*l.* 1*s.* the answer.

"*Rule* 3.—The cost of a given number of articles may be found by reckoning the cost of the given number at prices easy to be calculated mentally, the sum or differ-

Digitized by Google

ence of which prices make the given price, and then finding the sum or difference of costs.

"*Example* 1.—What is the cost of 37 yards at 7*d.* per yard? Here 37 sixpences are 18*s.* 6*d.*, and 37 pence 3*s.* 1*d.* These added together give 1*l.* 1*s.* 7*d.* the answer.

"*Example.*—What is the cost of 39 gallons of spirits, at 12*s.* per gallon? Here 39×6=234, which gives 23*l.* 8*s.* for the answer.

"*To know whether any given Year be Leap Year.—Rule* 72.—Divide the excess of the year above hundreds by 4, and if none remains it is leap year; but if any remain, it denotes the number of years after leap year.

## SOCIETY FOR PROMOTING PRACTICAL DESIGN,

*And diffusing a Knowledge and Love of the Arts among the People.*

THE operations of this society are founded upon the report of the parliamentary committee, of which Mr. Ewart was the chairman, and which consisted of Lord Francis Egerton, Sir Robert Peel, Messrs. H. T. Hope, Ridley Colborne, Wyse, Howard Elphinstone, &c. &c. Its object is to spread a knowledge of the arts among the people, and to shew the various modes of applying them to the different branches of trade and manufactures. A branch society has been formed at Manchester to act in connexion with this central society, and similar branches are contemplated elsewhere.

There is scarcely any pursuit with which the arts are not immediately or remotely connected. The enginemaker, the builder, the upholsterer and decorator, the coachmaker, the goldsmith and jeweller, the patterndrawer, the engraver and printer, the tailor, and many more, are by profession either designers, modellers, or colourists.

These objects of the society will be carried into effect by the following courses:—

### GENERAL,

1. Drawing, with elementary geometry, optics, and perspective.
2. Modelling and construction, in clay, wax, wood, cork, metal, &c.
3. Light, shade and colour, with optics, perspective, and chemistry.

### SECONDARY.

1. Human figure and anatomy, from casts, and from the living figure.
2. Zoology, with classification, and comparative anatomy.
3. Botany, with classification and structure.
4. Ornaments and heraldry, with the elements of style.
5. Architecture.
6. Machinery, with practical geometry, and the elements of mechanics.

### TECHNICAL.

**In which these courses of instruction will be specially applied to the respective trades.**

Instruction will be imparted by means of classes, every evening during the week, except Saturday, from six o'clock until ten; to be accompanied by lectures on every Tuesday and Friday.

A Museum of casts and models of all kinds, and a library of the best foreign and English books and engravings, applicable to the pursuits of the pupils, are in progress.

It is also proposed to open a school for females (many of whose pursuits are intimately connected with the arts), under the superintendence of competent female teachers, who have already offered their assistance.

A subscription of one guinea per annum constitutes an annual member of the society, and of ten guineas, a life member. Subscribers have the privilege of admitting one youth, as a free pupil; and donors, one adult, as a free pupil, for every guinea donation.

*Subscription to the Schools, Lectures, Library and Museum:—*

For pupils under 16 years...2*s.* 6*d.* per qr.
For old pupils .....4*s.* 0*d.* do.
Admission to lectures, library and museum only...2*s.* 6*d.* do.

Donations and subscriptions will be received by Messrs. Snow, Strahan and Pauls, 217, Strand; by Mr. Elmes, at his offices, 9, St. Bride's Avenue, Fleet Street, and 11, Park Street, Westminster; and by the assistant secretary, Mr. William Vialls.

A committee meets every Tuesday and Friday evening at eight o'clock.

*Ringing Bells by Steam.*—A person, named Fleet, proposes to ring church bells by a steam-engine. His diagram displays a row of keys, like those of a piano-forte; these are affixed to the engine, by which means, the inventor states, that one person (an organist) may ring a peal or play a tune such as bells have been hitherto set to.

Digitized by Google

# THE CHEMIST.

## THE LEAD TREE.

(See Fig. iv. front page.)

Put into a common wine decanter about half an ounce of super-acetate of lead (sugar of lead), and fill it to the bottom of the neck with distilled, or else some pure rain water; then fasten one end of a piece of silk or thread to the cork, and add to the other end a piece of zinc wire or plate, and place the decanter where it cannot be moved; in the course of a few hours, beautiful chrystals will be seen adhering to the zinc, which will gradually become a most exquisite tree. As this mixture is a most deadly poison, it should not be tasted, nor be left in the reach of children or servants, without a previous warning.

R. H. N.

## THE MINERAL CHAMELION.

*To the Editor of the Penny Mechanic.*

Sir,—The following experiment is one that may with great propriety be called one of the miracles of chemistry, notwithstanding which, and the number of years it has been discovered, we believe that it is not generally known. We are indebted to Sheele for this most extraordinary composition, which is as simple as it is beautiful. Take three parts of nitrate of potass, and one of deutoxide of manganese, both finely powdered, and expose them, mixed together, to a strong heat for a little more than three quarters of an hour. The compound thus obtained possesses the following singular properties:—If about ten or twelve grains of this preparation be put in a glass, and some cold water be poured on it, the liquor will first turn to a green, then to a purple, and, finally, by beautiful gradations, to red. If hot water be used instead of cold, it will be of a violet colour. The colours will be more or less intense according to the quantity of oxide used. If a small portion of the chamelion mineral be used to four ounces of water, the colour will be a deep green; by addition of more water it will turn rosy, and become colourless in a few hours, giving a yellowish precipitate. When the liquid changes slowly, it is easy to discover other hues, which it takes in the following order,—green, blue, violet, indigo, purple, and red.

It is worthy of remark, that the greater the portion of the nitrate of potass, the colours take longer time to change, and where there is a greater quantity of manganese, the colours are very rapid in the changes, and much more intense. Hot water is much more powerful in its effect than cold. The two powders should be treated in an *open* crucible.

R. H. N.

## PHOSPHURET OF CALCIUM.

When phosphorus is made to act on lime in the dry way a dark coloured compound is formed, commonly called phosphuret of lime; but which is probably a mixture of phosphate of lime, and phosphuret of calcium.

For preparing it a green glass tube about two feet in length, and half an inch in diameter, shut at one end, is coated with clay and sand. At the shut end, about a drachm of phosphorus is placed, and over this some pieces of lime, which must be brought to a red heat by passing the tube through a chauffer, the phosphorus at the same time being kept cool. When properly heated, the phosphorus is then melted and made to pass in vapour over the hot earth, by which the action takes place, and the phosphuret is formed. When cold it ought to be removed and kept in a well-corked phial.

In this experiment it is probable that the lime, the decomposed part of the phosphorus unites with its oxygen to form an acid, while the remainder combines with the calcium to generate a phosphuret. The phosphuret thus obtained is of a dark brown colour, and has a peculiar odour. The action between it and water is remarkable. When thrown into it bubbles of gas are disengaged, which the moment they escape into the air are inflamed, they are therefore phosphuretted hydrogen, the oxygen of the water having united with the calcium, and the hydrogen with the phosphorus.

J. R. Watts.

## CHEMICAL EXPERIMENTS.

Take caustic-soda (common soda) and pour upon it muriatic acid, this will produce muriate of soda (our table salt).

Mix equal portions of sulphate of soda and acetate of lead (both in fine powder), let them be well rubbed together in a mortar, when the two solids will operate upon each other, and a fluid will be produced.

If muriatic acid be poured on a piece of carbonate of baryta, its action is slow, but if the carbonate be reduced to powder, and then mixed with the acid, there is a violent effervescence.

Digitized by Google

## INSTITUTIONS.

*The Southwark Literary Institution* has removed to Newington Causeway, near the Elephant and Castle, and the lectures are delivered at the School Rooms in Union-street, Borough.

## QUERIES.

"J. C. Junr." would be obliged to any of your Readers who would inform him of the place and time of meeting of the Society for the Encouragement of Arts, Manufactures and Commerce.—2. The reason why frost gives a sweetness to potatoes, which sweetness is entirely removed on the frost departing; (the late severe frost quite monopolised the potatoes, which I found to my cost.)—3. If the earth describe an elliptic in its revolution round the sun, why is it not at the one side, at the same distance from the sun as at the other? and why its distance from the sun at one end, should not be the same as at the other? Suppose, for instance, when the earth is on one side of the elliptic, its distance from the sun be one mile, why should not the distance be the same when it arrives at the opposite side, and the same of the poles of the ellipsis? Perhaps your intelligent Correspondent, "Q. E. D." will solve me this unscientifically-arranged problem. He would much oblige

Yours, &c.

J. C. Junr.

Sir,—I shall feel obliged to any of your Correspondents who will inform me of the best method of preparing Turkeys Maws. R. S. L.

## ANSWERS TO QUERIES.

Sir,—In compliance with the request of your Correspondent "O. P. Q." I beg leave to offer my opinion upon his method of estimating the rational value of a mixture of different ingredients. The process he has described, is *perfectly accurate in all cases*, for since he obtains the value of the whole aggregate weight, it is clear that the value of any portion thereof is proportional to its weight; therefore

65cwt. 1qr. 25lbs. : 1cwt. :: 18*l.* 1*s.* 9½*d.* : *value*

of 1cwt. The error which occurred in his example, was occasioned by an oversight in the addition (15 being put for 25); if the other values are correct, no error will be found in the result. It is important to observe that no operation of division or multiplication is practicable, unless one of the sums be an abstract number; that is, a number or fraction of unity, separated from the object from which that unity may be derived. Five shillings cannot be multiplied by three shillings and four pence; but one fourth of a pound may be multiplied by the abstract fraction of unity, one sixth; also five shillings may be multiplied by 3⅓, and 60 pence by the abstract number 40; all of which operations will produce widely different results. In the previous example, although the *weight* appears to be taken as a divisor, it is not so in reality; the accurate expression (sub. and.) is as follows: as the *number* $\left(65\frac{53}{112}\right)$ which represents the cwts. contained in the whole weight, is to unity, so is the *number* of pounds contained in the value of 1cwt., which is the quantity represented by unity.

I remain, &c. Q. E. D.

Sir,—In No. 73 of your useful little work your Correspondent "Philo" has dilated upon the imagined incorrectness of a rule given in No. 68. I beg to tell him in his extremities he has neglected to cross the band. J. T. G.

*To prepare Copal Varnish.*—"Mechanicus" is informed that the best copal varnish has more or less spirits of wine in it; and that the separation of the copal is owing to its inferiority. Perhaps a varnish composed of copal one part, and oil of turpentine six parts, would suit his purpose.—For works on Lathes and Turning, see Martin's Circle of the Mechanical Arts, and Ibbotson on Eccentric Turning. The best in print is a French publication, entitled "Manuel de Tourneur." E. B. W.

Sir,—In answer to your Correspondent "A. W. Lane," I beg to say, that to describe accurately the best form and construction of the sails of a windmill is scarcely to be expected in a little work like yours, as such is a subject of considerable intricacy, and would require both a long and operose detail, and numerous graphical designs: the best form can be seen at any windmill; and if "A. W. L." knows of one, I would advise him to go and examine its construction, or refer to some well written cyclopædia.

As to the best angle at which the wind ought to strike the sails, so that the effect should be the greatest, may be determined as follows:—

Let $x$ = cosine of the angle,

then $1 - x^2 = \sin^2$ { radius = unity / by trygonometry,

and by hydrostatics the effect will be as $x \times (1 - x^2)$

$= x - x^3$,

which by the question must be the greatest, or a maximum,

differentiate $x - x^3$ and it will give

$du = dx - 3x^2\,dx$ = maximum,

$\frac{du}{dx} = 1 - 3x^2$ from which we can determine $x$

$3x^2 = 1$

$x = \sqrt{\frac{1}{3}} = \cos.\ 54^0\ 7'4.$

And in regard to the teeth of wheels, the involute of the circle is the best, for the friction and jarring consequent to other forms of teeth are avoided, and the motion and resistance is much more uniform; they are the best for raising a vertical piston, &c., for the convexity of one tooth always acts at right angles to the concavity of the opposing tooth.

For the teeth of wheels, &c., see Vol. 1, of Playfair's Outlines of Philosophy, and a work on the Teeth of Wheels by Camus. Tyro Lock.

## TO CORRESPONDENTS.

Q. E. D.'s *paper on the Crank, &c. has been received.*

C. Parke, on Acids, *will be noticed, as also the continuation of his papers on the same subject.*

*We have no recollection of having received letters from* J. Jessop *before this week; and if he should feel inclined to favour us with any more of his Queries, we must request that he will pay the postage.*

A Traveller. *We have been informed that the opening of the Birmingham Railway to Denbeyh Hall, is postponed till the 9th of April.*

J. S. *We see no reason why Mr. Mathews' improvement on the paddle-wheel should not be likely to supersede those at present in use. He does not profess to be a scientific or theoretical engineer—but a* practical *one.—There have been a vast number of improvements on the paddle-wheel, but the principal part of them have only been slight alterations from the old one. To be in the fashion, and to add some importance to the name of a man, he must have a paddle-wheel named after him. There has been something like the old well-known London cry of "Now is your time, Ladies, to bring out your old fenders that want painting;" the productions generally being nothing more than the old head, with a new hat.*

A Subscriber from the beginning. *The coal-pits of this country are inexhaustible.*

London: Printed at the Holloway Press, by D. A. Doudney: where all Communications are to be addressed (post paid); published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

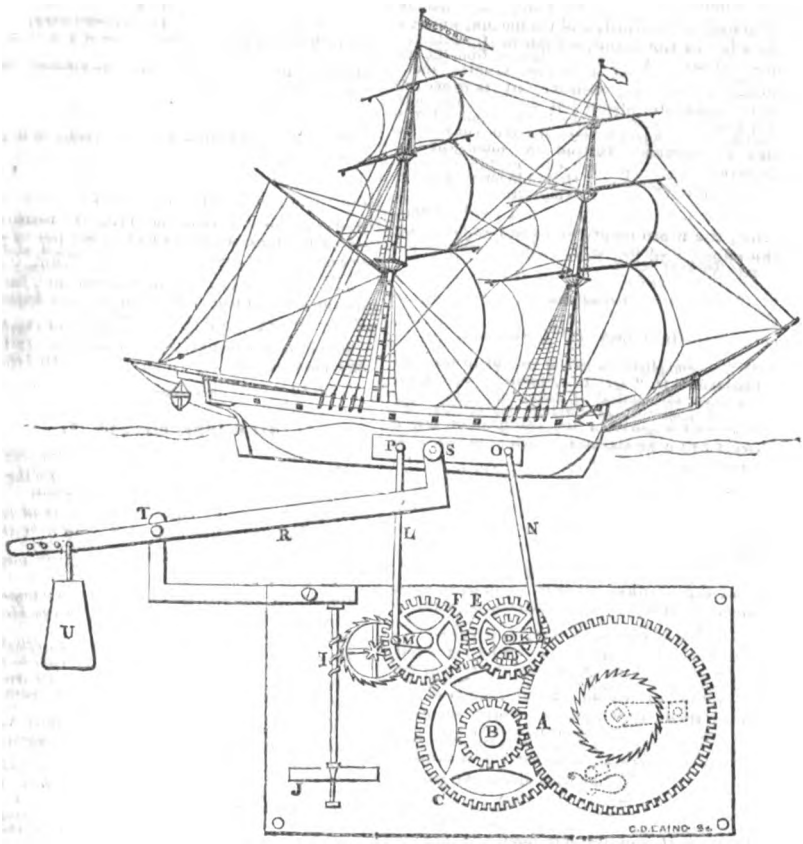
Digitized by Google

# THE PENNY MECHANIC,

## AND THE CHEMIST.

Nos. LXXVIII. & LXXIX] APRIL 7, 1838. [PRICE 2d.

### AUTOMATON SHIP.




VOL. II.—NOS. LXXVIII. & LXXIX. Holloway Press: D. A. Doudney.

Digitized by Google

## AUTOMATIC SHIP AND SEA.

*To the Editor of the Penny Mechanic.*

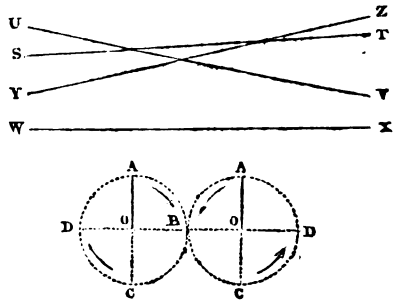
SIR,—Observing that one of your Correspondents "K. V. Crofts," wishes to know how the automatic ship and sea is constructed, such as that at the Adelaide Gallery, Strand, I beg to hand you the following description, which I think will be found perfectly correct.

The effects of this automaton, like several of its predecessors, are extremely perfect, and the mechanism which produces them is equally simple. It is concealed in the model by the membrane V, which is attached to the hull, and thence extends to the edge of the stand, which is the machinery chest, where it is fastened. This membrane is very delicate in its texture, and extremely pliant; it is not strained tight, but, on the contrary, left very full, and its surface painted to represent an agitated sea. In all the elevations and depressions of the vessel, this membrane of course accompanies it; but to the spectator, the motions of the vessel seem to be the effect, and not the cause of the waves.

In the diagram, one of the containing plates of the machinery is removed to show the connection of the parts. A spring, contained in a barrel, A, communicates motion through a train of pinions and wheels, B C D, to two wheels, E F, which have each the same number of teeth, and are geared together; on the axis of these wheels are cranks, M K, which move two shafts, L N, attached by centre-pins to the wheel of the vessel. To the keel is also attached, by a centre-pin, a lever R, which, resting on a fulcrum T, is continued beyond to any convenient length, and has near its end a moveable weight attached, U; one of the cranked wheels, F, is geared by a pinion and wheel, and an endless screw, I, with a fly, J, for regulating the velocity.

Supposing the lever, R, to be removed, the cranks and the shafts vertical, and the machinery in action; it will be seen, by examination, that motion would be communicated to the vessel, but that it would be simply vertical, a mere up-and-down movement, and that the deck would always be parallel to the line in which it lay at starting. If we add the lever, R, centering it midway between the centre-pins of the shafts, a very small, but scarcely a perceptible variation would be produced; but if now we place its centre-pin, S, nearer to the centre-pin, P, of one of the shafts, than to that of O, of the other, we shall have the motions of the centre-pins so controlled by the radius, S T, that they move, both ascending and descending, with different and differing velocities, so that the stem and the stern of the ship will rarely remain for two successive instants in the same level plane.

In the following diagram, are clearly




shown the positions of the deck, which correspond to four successive and simultaneous positions of the cranks. The arrows indicate the direction in which the cranks turn round. When the cranks stand at O A, the deck will be in the position S T; as the cranks move to one position O B, S will ascend to U, and T descend to V, and the deck will be at U V; during the cranage of the cranks to O C, U will descend to W, V to X, and the deck will attain W X; let the cranks go on to O D, W will now ascend to Y only, but X to Z, Y Z becoming the position of the deck; as the cranks go on to the starting position O A, Y will ascend to S, and Z descend to T; the deck will arrive at S T, the position whence it set out. It may, therefore, be seen, that in each interval of time the motions of the stem and stern are different, one of them being always greater than the other, and that at two points in the course, the one which was the greater becomes the lesser, and *vice versa*. It is owing to the ingenious introduction of the lever and its peculiar position, with regard to the shaft centre-pins, that the pitching of a ship in a brisk gale and high running sea is so beautifully imitated. By the weight, this pitching can be made quicker or slower at pleasure.—Hoping the above description will be serviceable to your numerous readers, I remain yours, &c.

SCIOLISTERUS.

*Birmingham Railway.*—This great line will be opened April the 9th, from London to Denbigh Hall, 48 miles, and from Birmingham to Rugby, 29 miles, leaving an intermediate space of 35½ miles, which will be finished in the next autumn.—*Railway Magazine.*

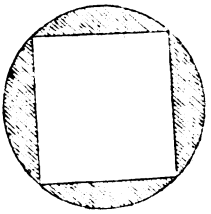
Digitized by Google

## TIMBER MEASURING.

*To the Editor of the* PENNY MECHANIC.

SIR,—As a *mere geometrical question*, there can be no doubt that the mode of calculation for round timber proposed by your Correspondent in the two last Numbers of your Penny Mechanic, is much more correct than the method generally used in the trade, which, as regards the true cubical contents of round timber, is perfectly fallacious. I shall, however, speak on this point presently. In the mean time I may remark, that had your Correspondent taken the ratio of 22 to 6·99 for determining the diameter, instead of 355 to 113, as given by Archimedes, in his "Dimensione Circuli," he would have come nearer the *true* cubical contents of his round timbers than he has done. Let us try this, with respect to his case No. 1. The main girth is there given 37.9; now, as 22 : 6·99 :: 37.9 : 12·04 the mean diameter; then say, as 14 : 11 :: $12{\cdot}04^2$ : $113{\cdot}898 \times 66{\cdot}22 = 7{,}535{\cdot}22$, the cubical contents, which is within 5· and a fraction of the *true* contents, instead of 17, as in the operation of your Correspondent. I do not mean to say that *his* operation is not quite near enough for all practical purposes, and in constant use by the best geometricians on occasions where the greatest accuracy is required.

This is all very well as pure elementary calculation for mere analytical discussion, or the advancement of exceedingly valuable materials. But it is well known to timber merchants, as well as to the growers of timber generally, that it would be quite preposterous to adopt any such *refined* method of ascertaining the cubical contents of *rough round timber*; not on account of the difficulty of the calculation, but on account of the positive injustice of its application. Why should a timber merchant or a carpenter pay for *slabs* and *chips*, for which he has no use, but an immense labour and expense to get rid of? When these are cleared off, I will venture to say, that the valuable part of the tree No. 1, of your Correspondent, will not much exceed 5,945 cubic feet, as determined by the usual mode of reckoning, namely, squaring the fourth of the mean girth, and multiplying it by the length of the tree. Let us suppose, for example, that the following circle represents the mean girth of a tree =21 feet, and the diameter in round numbers =7; the mean area of this, according to *rigid geometrical calculations*, would be 38·5, and would include all the chips and slabs, or shingles contained in the shaded parts; whereas that part of the timber which is contained within the quadrilateral figure (whether



square or oblong), is the only portion which, generally speaking, can be considered as the timber of commerce, if I may so use the phrase. This, if referred to a scale, will be found to measure about five feet in diameter, equal to an area of 25 feet instead of 38·5. Now if we suppose the tree to be 40 feet long, the cubical contents, according to the geometrical mode of calculating cylindrical bodies, as proposed by your Correspondent, would be 1540 feet, whereas, by the mode of measurement in general practice, it would only amount to 1080 cubic feet, which is even 80 feet too much, making a difference upwards of 460 feet against the merchant and in favour of the grower, to the decided loss of the merchant. Theory and practice are very different matters.

Your obedient servant, W. T.

5, Southampton-street, Fitzroy-square.

## ON THE NATURE AND PROPERTIES OF STEAM.

NO. X.

VIS VAPORIS.

HIGH-PRESSURE steam-engines are those in which the steam, after having performed its work, is not condensed, but allowed to escape into the air. The steam used in these engines has a pressure considerably higher than that used in condensing engines, and, therefore, the production of a vacuum and its consequent accession of power is of little moment in these; which, from being devoid of condenser, air-pump, and cold-water pump, to supply condenser and cistern, are rendered extremely simple in their construction, consisting only of the cylinder, steam valves, piston, and rod, and means of applying the power by beam, cranks, &c., as in low-pressure engines; and this simplicity is increased by laying aside the beam, and working the crank by means of connecting rods from the cross head, which renders the engine remarkably compact; and as the steam used has a greater expansive power, so a

Digitized by Google

smaller engine will suffice to do the required work; and from the previous statements it will be seen, that the higher the pressure of the steam, the greater will be the economy resulting from its use; wherefore it clearly follows, that high-pressure engines are smaller, simpler, more compact, and more economic, than low-pressure engines, and these advantages increase as the pressure increases; added to which, the first cost of high-pressure engines is less than half that of low, of corresponding power. Practical difficulties, however, attend the use of *very* high-pressure steam; but to what extent the working pressure should be carried I will not undertake to say, as it must entirely depend upon the construction of the engine, the work it has to perform, and upon various other circumstances applicable only to particular instances.

Those engines are said to work *expansively*, in which the steam is cut off from the cylinder before the stroke is finished, leaving the remainder to be performed by the expansive power of the steam. Great gain results from using steam expansively, which method is applicable to both high and low pressure engines; and it has been by many carried to the extreme. Hornblower and others used two cylinders, working the steam first in a small one, and allowing it to expand into a larger one, and there work another piston. All the advantages, however, to be derived from working expansively, can be obtained in an equal, if not even greater degree, by the use of one cylinder, thus avoiding complexity and needless friction.

C. D. Thomas.

## POKEROLOGY.—THE CRANK.

*To the Editor of the Penny Mechanic.*

Sir,—As some interest has been excited respecting the effect produced by placing a poker over the fire when nearly out,—one person giving his opinion that it is an erroneous idea, while others consider it beneficial as assisting combustion,—and I am one of the latter, I wish to state my opinion why I consider it to possess that property.

My idea is, that a cold bar of iron (say the poker) being placed direct over the portion of fire and within three inches of it, condenses or absorbs the hot air arising from the fire more rapidly than it would otherwise ascend, and by that means causes a greater current of air to pass through, the oxygen of which causes combustion to proceed more rapidly. It appears to me, that iron will continue to attract heat till it becomes as hot, or nearly so, as fire, and will cause the air that is divested of its portion of oxygen and possessing a great portion of heat, to draw towards it. I wish to be understood in stating my opinion that it is so, that I am not certain of it; but until I see some reason adduced, more plausible than I have hitherto seen, I shall continue to consider my own opinion right. I have often, when the fire has been nearly out, placed the poker as described, and do think that it is of service. I hope that "Q. E. D." or any other person, will pursue the inquiry till it can be proved that one idea or the other is erroneous.

I shall be greatly obliged if "Q. E. D." will explain his opinion respecting the action of the crank, showing, in as simple a manner as possible, how the power of the engine on the paddle-wheel is as much when the crank is at zero, as when it is at its full extent of leverage, or midway between the centres. Should "Q. E. D." be able to prove that it is so, he will undeceive myself and many others that read the "Penny Mechanic." I do not consider that "Q. E. D." wishes to mystify the question, neither do I see what advantage he would gain by it; but I think he has decided too hastily, and I expect that he will find, by a practical experiment, that his theory was wrong; and should it be so, I have no doubt but he will readily acknowlege it; if otherwise, he will confer a benefit on working mechanics by setting them right. and I trust "Q. E. D." will not forget to render any calculation that may be necessary as simple as possible, as many of the readers of the "Penny Mechanic" have but a slight knowledge of arithmetic.

I am, Sir, yours, &c.

T. L.

## NEW LOCOMOTIVE.

Messrs. R. and W. Hawthorne, of Newcastle, have lately constructed a new locomotive engine, invented by T. E. Harrison, Esq., of Whitburn, engineer of the Stanhope and Tyne Railway, and patented by him in December, 1836, destined for the Great Western Railway, differing most essentially from any hitherto in use. Its construction and advantages are thus described in the *Sunderland Beacon*; 1st. The machinery and boiler being placed upon separate carriages and wheels, enables the conducting engineer not only to have an unobstructed view of whatever may be likely to impede his progress, but

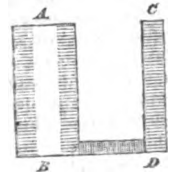
Digitized by Google

also, from the situation of his seat, to have almost the whole of the machinery within his reach. Mr. Harrison seems convinced, from his experience on the Stanhope and Tyne Railway, that a fourth part of the expense for repairs to locomotive engines, arises from the position of the machinery with regard to the boiler, parts of which are subject to considerable strain from the expansion and contraction of the boiler; and when any extensive repairs are necessary, the removing of the boiler, or what is called stripping the engine, is almost equivalent to rebuilding it. This the present arrangement is calculated to obviate, as well as to prevent delay to the engines when under repair, since the boiler can be detached in a few minutes, and either the boiler or engine united to another, as the failure may be in machinery or boiler. 2nd. The machinery thus constructed, is capable of being made more substantial, every part bearing a ratio of strength to a standing engine. An opportunity is also afforded of getting up a considerable increase of speed (at the same time keeping down the velocity of the piston), either by having wheels of larger dimensions, or, as in the present engine, by means of toothed wheels, which gives the revolutions to the driving wheels, for each stroke of the piston, the great advantages to be derived from which, can only be appreciated by those whose experience has enabled them to estimate the destruction by wear and tear attending such extreme velocity being given to the piston, not the machinery only, but also to the fire-box, owing to the great pressure and velocity by which the steam is injected into the chimney; thereby raising the temperature of the fire to such an extent, as greatly to hasten the consumption of the material it is made of, whether iron or copper. 3rd. The boiler is of the same construction as those of other locomotive engines, except in the fire-boxes, which have two doors, and is divided into two parts by a chamber or reservoir suspended from the top, which, therefore, by presenting a greater area of heating surface to the action of the fire, hastens the generating of steam without increasing the temperature. — *Railway Times.*

## HYDROSTATICAL PARADOX.

*To the Editor of the* PENNY MECHANIC.

SIR,—"Q. E. D." some time since, introduced a series of questions in one of your preceding Numbers, amongst which was a problem generally known as the hydrostatical paradox, a proposition that at first sight is generally very embarrassing to the mathematical student. In the answer to the same question, which "Q. E. D." afterwards inserted, he stated that there was nothing at all paradoxical about it; to this I certainly agree, when the law of hydrostatics are understood, there will not be any difficulty in seeing the truth upon which the paradox is bottomed; but to those who may not be acquainted with these laws, it will undoubtedly appear paradoxical, for to appearance a lesser quantity maintains a greater, which is absurd, —to appearance—and to appearance only, as will be seen. The paradox is generally expressed as under. A quantity of fluid however small, is made to balance a quantity however large, and that to, without anything assisting, except the vessel which supports it.



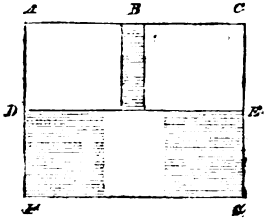

Thus let A B be the larger, and C D the smaller vessel, both connected so that the fluid may pass freely from A, through B D to C; then if water be poured into either of them it will find its level, and consequently rise to the same height in either vessel, consequently there will be an equilibrium between them. The paradox then appears in this form—why does not the greater quantity, by its superior weight, force the lesser up, so that it shall run over at C, the top?—and if it does not do so, then must the less support the greater, which appears directly contrary to the laws of mechanism. All these difficulties and paradoxes may be explained readily upon pure mechanical principles; and what is of more consequence, an explanation conducted in this manner, strips it completely of every paradoxical appearance. Now it must be observed that there is an equilibrium between them, in the same way as power and weight in the simple lever, by the intervention of the vessel that supports them, for we may consider the vessels as a lever. Take the lever for instance, and with 1lb balance 100, this is exactly the same as 1lb balancing 100lbs in the hydrostatical paradox; for in the former case, by the known properties of the lever, the equilibrated arms must be in proportion to each other, as 1 to 100; and in the paradox the areas of

Digitized by Google

the vessels must also be to each other as 1 to 100. But strictly speaking, one pound cannot balance 100, place them as you will. Archimedes only wanted a fixed point to sustain the whole earth; but it has been observed, that if he had found it, it would not have been Archimedes that sustained the world—but the fulcrum,—the same observation applies to the above. In the hydrostatic paradox, one pound only balances one pound—all the rest being maintained by the cylinders—for split them, then see where the equilibrium will be, the weight in this case being supported exactly the same as the fulcrum sustains the lever in the former.

Now to shew that the same takes place as in the lever, fix a piston in either of them, the greater for instance, then if the area of the greater be to the lever as 100 to 1, by pressing the piston in the greater down one inch, the water would rise in the other 100 inches: this must be evident, for by the question the area of the less is but one inch or any unit, and that of the greater 100, and since the piston descends one inch, it must force 100 inches out of the greater, which will rise in the less 100 inches; this is precisely the same as the lever; for if the arms of the lever are as 1 to 100, the longer will move through 100, whilst the shorter moves through one, which is a fact well known to every one that is the least acquainted with mechanics.

And upon a similar thing depends the solution of "Q. E. D.'s" question; for let D E F F be a cylinder, and B a smaller one,




then the pressure on the base F G of the main cylinder will be equivalent to the weight of the whole cylindrical contents D E F F of the water; but if the smaller cylinder be filled with water also, then the pressure on the bottom will be increased in the ratio of the lesser to the greater, for it is a well known property of fluids that they press equally in all directions, so that if the area of the less cylinder be A, and the greater B, it will be increased in the ratio of A to B, for the force on the area A, is by the above law transmitted to every area equal to A in B; and consequently this pressure will then be the same as if the cylinder had been filled up to A C F G, the smaller cylinder B, being in this case the same as the quill in "Q. E. D.'s" question.

It is upon the principle explained in fig. 1, that Bramah applied the hydrostatic press; for suppose the diameter of the cylinder piston to be twenty inches, and that of the smaller or the pump piston, which is used for forcing water into the cylinder to be one-quarter inch, then the area of the cylinder piston is $= 20^2 \times 7854 = 314{\cdot}16$ square inches, and the area of the pump piston $= \frac{1}{4}^2 \times 7854 = \frac{1}{16} \times 7854 = {\cdot}0491$. Then the area of the cylinder piston : the area of the pump piston : $314{\cdot}16 : {\cdot}0491 = \frac{314{\cdot}16}{{\cdot}0491} = 6400 : 1$, or they are in the equal ratio of 6400 : 1. And if any force is applied to the small piston, it will produce an effect on the large one as 1 : 6400; if there be water or any incompressible fluid whatever between them to transmit the pressure; it is very plain that incompressible fluids are the most proper to be used for these purposes, for the pressure of the piston would condense the fluid were it compressible, and very little, or no effect would take place.

Suppose that by means of a lever, or any other power, we could press down the less piston with a force equivalent to 10 cwt., then the large one will ascend with the force of $10 \times 6400$ cwt. $= 3200$ tons; and the same way of computing the results will apply, let the ratio of the pistons be what they will; this example shows very clearly the great power that may be obtained from a machine of this nature, with very little cost:—this is a seventh mechanical power.

How admirably is it adapted for packing machines and presses—a purpose to which it is chiefly applied. It may also be applied for the purpose of proving steam-boilers previous to leaving the manufactory, by the compression of water; for suppose we have a boiler holding a known quantity of water, and also that the internal surface is known, say fifty square feet, which is consequently a small one, now fifty square feet $= 7200$ square inches; let the boiler be filled quite full with water, and a tight piston applied to the man-hole, or the safety-valve aperture, whichever may be considered the most convenient, then let the main piston of the hydrostatic press, as above, be brought to bear upon the piston applied to the boiler, and let the press be worked by steam or any other power with the same force as above, then

Digitized by Google

will the force transmitted on all the surface of the boiler be = 7200 × 3200 tons, which, reduced into pounds, and divided by the internal surface in inches, will give the pressure per square inch with which the boiler is strained or will stand. But the preceding example is much beyond the bounds of practice; steam-boilers are generally tried in this way, some of them up to 8, 9, and 1000lbs. per square inch—they always prove them far beyond the pressure it is calculated they will have to bear when in full operation.

The hydrostatic press is of great service in the manufacturing districts, as also to those connected with the warehousing of merchandise: they are much used in the cloth and paper districts for pressing and packing these materials into more convenient dimensions for moving; and it perhaps might by some little adoption be applied to coining, stamping, paper makers, and thin filagreed brass work; the steam-engine is more generally applied to these latter purposes.

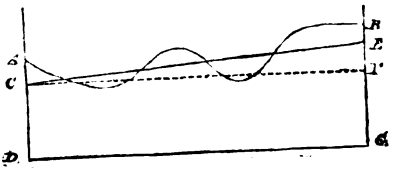
I am yours respectfully,
TYRO LOCK.

## ON LEVELLING.

NO. VI.

HAVING in the preceding papers shown how to take and reduce a series of observations, we will now show how to find the inclinations of the new road, as to be determined by the nature of the section. When a line of country has been surveyed and levelled, and accurate plans and sections made, the question next arising is to determine on the section a line that shall represent the position of the surface of the new road or canal; if the latter, it must be level by the laws of fluids, but in the former case, it may be at any convenient inclination. A little reflection soon tells us that this line cannot be taken or assumed by chance, it must be regulated by local circumstances; let us suppose the distance of any two towns not to be great, and consequently the section not long, the grand object to be obtained is this, to draw and so regulate the line that there shall be nearly as many hills above as dales below, or in other words to regulate it so that the quantity of earth to be removed from the cuttings, may be sufficient to form any embankments that may be required, and consequently fill up all the dales, and thus make the surface as nearly level as circumstances will admit; this is the great object of the engineer, the more nearly this is accomplished the more economical will be the expenditure; and for this purpose he has, by the section, a complete profile of the general surface of the country; he then draws this line from town to town on the section regulating it as above, and since the height of every perpendicular on the section has been determined by levelling, the *extreme* heights are also known, and from these data the actual position and inclination of the road can be accurately determined, which must always be done before any determinate idea of the expence can be ascertained. This question resolves itself into two; first to find the inclination for the whole length, and then the same for one foot, or as it is practically termed, the rise per foot. We now proceed to the investigation of the rule.

In the diagram let A and B be any two distant towns, and the curve line joining A and B, the surface of the country between them; and let C E be the proposed




surface of the new road whose inclination has to be determined, draw the dotted line C F parallel to the base line D G. Now it must be obvious that before we can find the inclination, C E must be reduced to D G in order to compare it, for this purpose we have *given* the heights C D and E G, and obviously the reduction is directly effected by taking the difference as proved by the dotted line; therefore E G — C D = reduced value or height, which is equivalent to E F; and the question is now reduced to finding the inclination of the hypothemus of the right angled triangle C F E, having given the height E F, and the length of base C F or D G. And now referring to the rules investigated in page 99 we find as under; let L = length H = height then

H : L :: 1 : incline on the whole

and assuming the same dimensions as there given we have

H = 20 L = 1000 ∴ H : L :: 1 : incline

$$20 : 1000 :: 1 \therefore \frac{1000}{20} = 50 \text{ whole incline,}$$

or the inclination is one foot in fifty, that is for fifty feet length of base, it rises one foot, which in actual railway practice is considerably too great: the above example assumes E F, the differencce of C D and E G, to be 20 feet, and D G 1000 feet; and

Digitized by Google

by the same rules to find the rise per foot we have

L : H :: 1 : incline for unit of length

$$1000 : 20 :: 1 : = \frac{20}{1000} = \frac{1}{50} \text{ of a foot,}$$

which is proved by direct reversion, thus

$$1000 \times \frac{1}{50} = 20, \text{ original height;}$$

that is for one foot in length it rises $\frac{1}{50}$ th of a foot; this example places in a very clear light the extreme simplicity and ease of the rules as given above, and also those given in page 99 already referred to.

We may therefore tabulate the general rule as follows:—

RULE.—If the incline is already refined or reduced to the standard base line, nothing more is necessary than to divide the length by the height, for the total inclination. But if not reduced to the base line, it must be reduced to it by taking the difference of the heights at the extremity of the line, and this difference is the height properly reduced; then proceed as by the rules in page 99, &c.

Suppose now, by way of experiment, we take another example for this purpose;

Let C D = 10 feet, and E G 20, then E G — C D = 20 — 10 = 10 ft. reduced height;

then by the rule $\frac{L}{H} = \frac{1000}{10} = 100$ feet;

by the same $\frac{1}{I} = \frac{I}{100}$ = incline per foot;

that is, to a distance of 100 feet, it rises one foot, and conversely to a distance of one foot it must rise $\frac{1}{100}$th of a foot. And by this rule may any incline be reduced. In the present stage the utility of these rules is not very manifest, but the next paper, which will investigate a rule for finding the "averages," will exhibit their extensive use.

What can be more simple than these rules? nothing; and yet in practice this is considered as rather a difficult question by most of our engineering students. From whence arises this difficulty then? From their indolence; at least I can see no other reason.

I am, &c.

TYRO LOCK.

*Manchester and Bolton Railway.*—This railway will be completed in April next. —*Coventry Herald.*

## NEW-MOTIVE POWER.

*To the Editor of the Penny Mechanic.*

SIR,—Having most respectable reference of opinion relative to an engine of the most simple construction, but powerful in its operation, and universal in its applicability, which would on all considerations be preferable to steam for generation of power, I beg you will do me the favour of stating, that any person desiring to aid me in the humane project of enabling the public to avoid the continuance of such calamitous exhibitions as were witnessed recently on board the *Victoria Hull Steamer*, will be immediately waited upon by your humble servant, L. S. D.

[Any of our readers who may feel inclined to assist the above individual in maturing his project, can receive every information on making application at our office.]

# BIOGRAPHICAL SKETCHES.

## EDWARD TROUGHTON.

EDWARD TROUGHTON was born, it is believed, in October 1753 (the parish register for that time being destroyed), in the parish of Comey, on the south-west coast of the county of Cumberland, the third son of a small farmer of that county, a *statesman* (i.e. one who farms his own freehold), according to the language of that county. An uncle of the same name, and his eldest brother John, were settled in London as mathematical instrument makers; and as his second brother was apprenticed to the same business, Edward was designed to be a farmer, and continued to be his father's assistant till the age of seventeen. To persons acquainted with the condition of that part of England, it need not be said that his education was not better than is usual for his rank, and was of a sound though homely cast.

There has always been in Comey, so far as memory goes back, a considerable stock of mathematical and general knowledge floating amongst the people; and a large proportion of persons distinguished for their attainments in the University of Cambridge have arisen from among the Cumberland and Westmoreland yeomanry. The death of his preceding brother altered Edwards destination, and he was placed with his brother John, then a chamber master, employed chiefly in dividing and engraving for the trade and the higher branches of the art. Under the instruction of his brother, who was an excellent workman, Troughton made most rapid

Digitized by Google

progress, and at the expiration of his time was admitted as a partner. About 1782, the Troughtons established themselves in Fleet-street, where they commenced an independent business as successors to a series of well-known artists (Wright, and subsequently Cole), who had previously occupied the same premises. Ramsden was then in the zenith of his reputation, but his dilatory habits were little suited to the wants and impatience of astronomers, and this, and their own intrinsic merits, speedily advanced the brothers in their profession, and in the estimation of competent judges. Considerable rivalry ensued, and Troughton, who felt his own powers, was not a person to conceal his feelings, or to propitiate to an adversary. After the death of his brother John, Edward alone continued the business, latterly at a loss rather than *profit*, till 1826, when his increasing age and dislike to routine employment, induced him to take Mr. William Simms as *his* partner and successor. Mr. Troughton died at his house in Fleet-street, June 12th, 1835, in the eighty-second year of his age, and was buried, according to his own request, at the Cemetery, Kensalgreen. Many of the members of the Society paid their tribute of respect to his memory by attending his funeral. An admirable bust of Troughton, by Chantrey, was executed some years before his death, at the expense of his private friends and admirers. This is placed, as he wished it to be, in the Royal Observatory, Greenwich.

The life of an artist is generally contained in a history of his works, and this is peculiarly true in his case. Of him it may be said with truth, that he improved and extended the use of every instrument he touched, and that every astronomical instrument was in its turn the subject of his attention. In this branch he had no equal, except the celebrated Graham, the object of his unbounded admiration. The instruments which facilitate navigation were peculiarly objects of interest to Mr. Troughton; and *long* after his infirmities were an effectual bar to the applications of his most esteemed friends, he exerted himself to supply the *seamen* with well-adjusted and accurate sextants. "*Your* fancies," he would say, "may wait; *their* necessities cannot."

With the same earnestness to promote navigation, he invented the ship leetor (afterwards re-invented by Dr. Wollaston), and expended time, money, and ingenuity, to no inconsiderable amount, in attempting to perfect the marine top for producing a true horizontal reflecting surface at sea. The marine barometer, the snuff-box sextant, and the portable universal dial, owe to him all their elegance and much of their accuracy. Where others invented or sketched, he perfected. It is, however, more properly with the astronomical instruments of this great artist that we are immediately concerned; and here he reigns without a rival. His portable astronomical quadrants are models of strength and lightness.

It may, perhaps, be remarked, that the only astronomical instrument which is not greatly indebted to Mr. Troughton, is the telescope; and he was deterred from any attempt in this branch of his art by a singular defect of his vision, which existed in *many members* of his family. He could not distinguish colours, and had little idea of them except generally, as they conveyed the idea of greater or less light. The ripe cherry and its leaf were to him of *one hue*, only to be distinguished by their form; and he was in the habit of relating some curious mistakes committed by himself and others of his relations, in confounding green and red. With this defect in his vision, he never attempted any experiments in which colour was concerned; and it is difficult to see how he could have done so with success. In the beginning of this memoir we stated that he continued business till 1826 by himself, but the last capital instrument made by Mr. Troughton *alone*, was a seven-feet transit for Sir James South, for Camden Hill observatory, in 1820, on the model of that at Greenwich,—*Minutes Astronomical Society.*

TYRO LOCK.

Camden Hill, Kensington,
March 6th, 1838.

## THE ARITHMETICAL QUESTION OF "O. P. Q."

*To the Editor of the Penny Mechanic.*

SIR,—As I consider that "Philo's" answer, in No. 72, is somewhat wide of the mark, I beg leave to subjoin what I trust will prove to be a satisfactory explanation as to the cause of "O. P. Q.'s" failure.

To find a correct "average" price by dividing the sum of the prices by the number of lots, either the *quantities* or the *price* must be expressed by *equal* terms; thus if the quantity be represented by 4, then must all the quantities be represented by 4, and the same with the prices; for if the quantities be represented by 4 and 3, and the price of the former be 2sh, and the

Digitized by Google

price of the latter 7sh, it will be impossible to obtain a correct average price by dividing the sum of the various prices, or the various quantities by the number of lots; for example:—

| Lot. | | | | |
|---|---|---|---|---|
| 1· | 4 at | 2sh = | 8sh | } = 32 |
| 2· | 3 | 8sh = | 24sh | } |
| | 7 | | 10 | |

Now divide the sum of the prices (=10) by the number of lots (=2), and multiply the quotient (5) by the sum of the quantities (=7), and the product will be 35, which exceeds the accurate amount by 3; for it is obvious that the number (3), taken from 8 and added to 2, to average them, has been repeated once more by being multiplied by 4, than it would have been, had it been left as at first and multiplied by 3; had the quantities been expressed by equal numbers, suppose

$$4\times 2$$
$$4\times 8$$

the sum taken from 8 and added to 2, to average them or make them both equal to 5, will be repeated just as often, when added to 2, as it would have been had it not been taken from 8, for both 8 and 2 are multiplied by 4, and

$$\left.\begin{matrix}4\times 2+3=20\\ 4\times 8-3=20\end{matrix}\right\}=40$$

therefore the sum of 8 and 2, divided by the number of lots, multiplied by the sum of 4 and 4, will give an accurate product; for

| Lot. | | | | |
|---|---|---|---|---|
| 1·— | 4 × | 2+3 = | 20 | |
| 2·— | 4 × | 8—3 = | 20 | |
| | 8 | 2(10 | 40 | |
| | | 5 | | |
| | | 8 | | |
| | | 40 | | |

And generally,

$$\left.\begin{matrix}a(b+c(=g\\ a(e-c(=g\end{matrix}\right\}=2g$$
$$\left.\begin{matrix}\therefore a\times b=g-c\\ a\times e=g+c\end{matrix}\right\}=2g$$
$$\therefore 2a\times b+e=2g$$

To advert more particularly to "O. P. Q.'s" example, which he has given in the following form:—

| "Lots. | Cwt. | Qrs. | lbs. | s | d. |
|---|---|---|---|---|---|
| 1 | 20 | 2 | 14 at | 8 | 6 |
| 2 | 20 | 1 | 7 at | 5 | 6 |
| 3 | 24 | 2 | 4 at | 3 | 4" |

It is obvious, that by dividing the sum of the three prices by the number of the lots, the same end is effected as by subtracting from 8*s.* 6*d.* a sum, parts of which, on being added to 5*s.* 6*d.* and 3*s.* 4*d.*, would make the three prices equal. Now the part of the sum subtracted from 8*s.* 6*d.*, and added to the price 3*s.* 4*d.*, is repeated, when thus added, more frequently than it would have been, had it not been taken from 8*s.* 6*d.*, for

| *s.* | *d.* | | Cwt. | Q. | lb. |
|---|---|---|---|---|---|
| 8 | 6 | is multiplied by | 20 | 2 | 14, and |
| 3 | 4 | ,, | 24 | 2 | 4, &c. |

And here, Mr. Editor, I would observe, that arithmetical errors frequently occur when in estimating the value of a quantity of goods by an average price, the fractions of *less value than a farthing* are not taken into account. In small sums or quantities, perhaps, the trouble of calculating the value of the fraction, may not meet with adequate compensation, but certainly, in large amounts, or when the fraction, however small its value, is repeated frequently, the calculation is of much greater importance than many persons suppose; for instance, 65 cwt. 1 qr. 15 lb. at 0½*d.* per lb., amounts to 15*l.* 5*s.* 1½*d.*, but increase the price per lb. by $\frac{3056}{7321}$ farthing, and 15*l.* 5*s.* 1½*d.* swells to 18*l.* 8*s.* 9½*d*

I remain yours, &c.

H. S. Thomas, jun.

March 20th, 1838.

*Machinery* v. *Steam.*—A practical experiment was made a few days since on the Southampton Railway, of a newly-invented machine, intended as a substitute for a locomotive steam-engine on railways, particularly on short or branch roads, where the expense of a locomotive steamer would be too costly for the traffic. The action is produced by a horse walking at an ordinary pace on a jointed platform attached to the vehicle, by a series of concealed machinery, which is so contrived that his weight and muscular strength are brought to act together, and communicate a multiplying force to the larger or outside wheels of the machine, which powers are capable of being increased or diminished at the will of the conductor, so as to regulate the required speed. The trial was perfectly successful, notwithstanding the disadvantages of an untrained horse and new machinery. On the first application the horse moved at a pace of four miles an hour, and subsequently conveyed the machine, which, with thirteen persons riding in it, weighed altogether four tons, at the rate of sixteen miles an hour. It was completed at the manufactory, and under the direction of Mr. Robert Jeffery, Gray's Inn Road. A number of scientific gentlemen were present.

Digitized by Google

## ON THE CRANK.

*To the Editor of the* PENNY MECHANIC.

SIR,—Your very talented Correspondent, "T. M," appears to me to fall foul of the opinions of "Q. E. D.," and that in no measured terms. I will readily grant to "T. M." that some of the remarks are *practically erroneous*, but the remainder are in strict accordance with the principle of the mechanism of the crank, and to save controversy, it is a pity that "Q. E. D." did not give the demonstrations with the principles. "T M." is, according to his own account, a *Practical Working Man*, and consequently one whose opinions are founded on actual experiments and observations, and therefore one whose observations are the more entitled to credit; but it is a matter of common observation, that practical men in general are not inclined to place an explicit reliance on the assertions of mere theorists; and the same may be said of theorist, they are but little in general for practical men, for they will urge that practical men often mistake the particular action or effect of a single cause to be a perfectly general one, and as such give way to an erroneous notion.

When "Q. E. D." asserts that there is not a loss, but only an *unequal* division of power, he may perhaps be theoretically true, but he is certainly *practically wrong*: there is not only an unequal division, but an actual, and extensive loss of power. "T. M." appears to disbelieve "Q. E. D.'s" assertion that the effect is the same, as the power acting on a lever equal to the length of the crank, at different distances, but this is *strictly* correct, and readily admits both of sinthetic and geometrical proof, though it may not be directly evident to a practical man. "Q. E. D." is not altogether guilty of absolute error, though he is chargeable with an excessive looseness in his expressions, which gives ground to doubt its truth, and renders ambiguous that which is otherwise sufficiently plain. "Q. E. D." is hasty, and often very unguarded in his terms; as a proof I beg to refer him to his own Questions 9 and 13, and then to his commentary on Wood's Mechanical Definitions.

Now the best way to end or prevent any farther controversy, would be for "Q. E. D." to give the desired demonstrations, and set "T. M." at rest; and also for "T. M." to collect and send his *practical* observations of different facts respecting the *practical* working of the steam-engine crank, by which it is highly probable that "Q. E. D." will satisfy "T. M.," and "T. M." inform us of something that may be of service to the whole of your readers, (this he can do without infringing on his rights as an inventor); and I must say that the assertion of "C. D. T.," that the crank, as a means of transfering power in the steam-engine, is the best that is yet known, and that a bare denial is not a sufficient negation, we require proofs; as far as our acquaintance with the steam-engine reaches, we have never observed a better substitute, and I believe no better is yet known to any of our most active engineers; but, however, it does not happen that such may not be the case; I merely say it is not yet applied practically. There are many instances of people having spent the labour of years to no purpose in making and perfecting a machine; and then perhaps, as a model on a small scale, they have prided themselves upon the perfection and success of their machines, which when practically tried has proved a failure. An instance of this occurred some years since in steam navigation, the model worked admirably, and to every body's satisfaction; but when built on a large scale and tried practically on the river it failed. There are several new paddles in the Adelaide Gallery, which appear to answer the intended purpose well, but on trial they have been found no better than those in present use; we must admit that there is plenty of room for improvement, and every possible encouragement ought to be given to practical men as an inventive incitement.

I do not wish to play the part of umpire between the opinions of "Q. E. D." and "T. M.," mine have been already briefly given, such as they are.

Camden Hill, Kensington,
March 19, 1838. TYRO LOCK.

## TYRO LOCK'S HUMBLE APOLOGY

FOR HIS "VITUPERATIVE SYSTEM."

*To the Editor of the Penny Mechanic.*

SINCE the appearance of my "vituperative" letter in No. 70, I have been waiting for the storm that has at length (justly) burst forth with all its fury on my devoted head. When I penned that letter, doubtless my senses had taken a *wool-gathering* trip, and had been blown to oblivion, or not far from it, by a sudden puff of enraged breeze. Well, "Q. E. D." on calmly examining my letter in print, I soon perceived that there was much to condemn in it, and naturally enough expected a rattling reply from you, which I have this

Digitized by Google

day the honour of reading, *not much to my edification.*

To quote the words of the ever illustrious Kepler, "Whatever I have said or written against the person, the fame, the honour, and the learning of your excellency; or whatever in any other way I have injuriously spoken or written (if they admit of no other favourable interpretation), as to my grief I have spoken or written many things, and more than I can remember; *all* and everything I *recant*, and *freely* and *honestly* declare and profess to be *groundless*, *false*, and *incapable* of *proof*;" for knowing that "Il est plus grand de vaincre ses passions que de conquerir des nations entieres," I have thus thought it my duty to make this public *recantation*, and leave the rest for the judgment of your readers, and the "light of other days."

I remain, Sir, your humble servant,

TYRO LOCK.

P.S. The vocabulary from which I obtained the word "*foolish*" and "*opaque*," was his *own*; they are to be found applied in all their generality in *his* letters, i. e. "*opaque* spot on the Doctor's mind," and "*foolish* work lately published," I merely italicised them that he might recognise them, and not to offend or wound his feelings.

## CAUTION IN MAKING EXPERIMENTS.

*To the Editor of the Penny Mechanic.*

SIR,—Knowing that a great many of your readers are persons who have not had the opportunity of making themselves acquainted with the principles of chemistry, and who are consequently ignorant of the best method of conducting experiments in the science, I take the liberty of offering a word or two by way of caution, on the experiments illustrative of "Combustion and Explosion," by Mr, Goddard, in No. 76. The first eight of these experiments *are exceedingly dangerous*, if performed by persons who have received no caution respecting them. I knew a young man who narrowly escaped losing his eyesight for life, in consequence of having mixed turpentine with nitric and sulphuric acids, and keeping too near the vessel that contained the mixture. I advise such of your readers as may feel disposed to practise the experiments, to use a *very small quantity* of the substances described; the same effect will be produced as if they used a very large quantity, and the probability of accident will be much lessened. Indeed in all experiments it is advisable to adopt this plan, and it is recommended by the most eminent chemists. It is also desirable in the above experiments not to be too hasty if the effect is not directly produced, as sometimes, by adding an additional quantity of the chemical, explosion, instead of combustion, takes place. I am, Sir, your obedient servant,

N. S. N.

## SOUTHAMPTON RAILWAY.

THIS company have spent during the past half-year 217,825*l.*; the total expenditure has been 947,042*l.* The line, in consequence of the late fine weather, is now confidently expected to be opened to Woking-common, 23 miles—as we two months since stated,—by May the 1st, and to near Basingstoke in the autumn, that is, six months earlier than was expected. The Directors expect to have full two-thirds of the entire line in profitable operation in the course of 1838, and the whole in the spring of 1840. The Report, which was brief but business-like, gave great satisfaction. In the course of the subsequent discussion, the chairman said he did not think the opening to Woking-common would be delayed, if beyond, not fourteen days beyond, May the 1st; that every care would be taken to ensure the company against a premature opening of the line. He made some sharp observations on Mr. Stephenson's Portsmouth line, and also the line from Pulborough to Horsham, and exhibited a humourous contrast between their zeal and want of money. Some high compliments were paid to the handsome conduct of Sir Thomas Baring, who had sacrificed even religious prejudices to support the line. In answer to a question about Sunday travelling, the chairman stated that he was one of a Select Committee of the Commons to make inquiries into it, and he expected an Act would pass this session to prevent companies from interfering with the necessities of the public by shutting up their lines on a Sunday. A resolution was afterwards passed to empower the Directors to borrow on loan any sum not exceeding 350,000*l.*, agreeable to their Act of Parliament. The meeting was throughout exceedingly gratified with the position and prospects of the Company.—*Railway Times*

*The Northern and Eastern Railway* is now in progress; no doubt seems to be entertained but that the line to Broxbourne will be finished within the year.

Digitized by Google

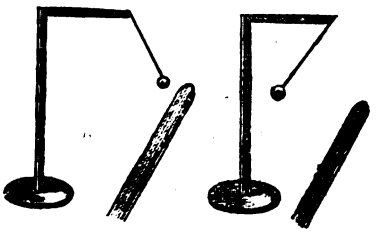
# THE CHEMIST.

## ELECTRICITY.

*To the Editor of the Penny Mechanic.*

1. If an excited electric be brought near a pith ball suspended by silk, the ball will, in the first place, approach the electric (fig. 6), indicating an attraction towards

FIG. I. FIG. II.



it, and if the position of the electric will allow, the ball will come into contact with it and adhere to it for a short time; but it will presently afterward recede from the electric, showing that it is now repelled (fig. 2). If we now remove the electric, and present to the ball which has thus touched it, a second ball which has had no previous communication with any electric, we find that these two balls attract one another, and come into contact. The same actions are repeated between the second ball and a third, which may be presented to it, and so on in succession, but with a continued diminution of intensity. This diminution plainly indicates a diminished power in consequence, as it would seem, of its being distributed among a number of bodies.

2. In the prosecution of these experiments, therefore, the effects will be more distinct, if, instead of small pith balls, we employ a globe of metal of larger size, which will allow of the reception of a considerable quantity of this electric influence by contact with the excited electric. A globe suspended by silk threads, as the pith balls are, and which as extensively touched the electric, would act upon these balls precisely in the same way as the original electric would have acted upon them, and may accordingly be substituted for it in these experiments. It is, indeed, exactly in the same condition as the pith balls already mentioned in No. 1.

3. From the whole of these facts we necessarily infer that the electric has imparted to the ball or globe which came in contact with it, properties similar to those which had been excited by friction; by repeated contact with a number of bodies, an excited electric is found to lose its electrical powers in the same manner as these powers have been acquired by the bodies themselves, and fresh excitation alone can renew them. It is evident that the unknown agent, which we have termed electricity, is capable of transference in the same sense in which we speak of heat being communicated or transferred from one body to another, and that, like heat, is weakened by diffusion among a number of bodies.

4. If the electrified ball be touched with the finger, it will be deprived of the whole of its electricity, which will pass into the body of the person who touched it. It is now reduced to its original or natural state, and is again susceptible of being attracted either by an excited electric, or by another body to which electricity has been previously communicated.

5. If the electrified body, instead of being touched with the finger, had been touched by a rod of metal held in the hand, the effect would have been the same in both cases; hence we may infer, that the metallic rod is capable of conveying away from the body the whole of its electricity. But if a glass rod be substituted, the result is very different; the body touched is found to retain the whole of its electricity, notwithstanding the contact of the glass rod. We are led to the conclusion that some substances, such as glass, are incapable of conducting electricity, while others, such as the metals and the human body, readily convey that influence. I remain yours, truly,

J. E. GODDARD.

## COMBUSTION.

IN our last paper on this subject we showed, by various examples, the necessity for the presence of oxygen, in order to effect the combustion of any substance. But before a combination of the combustible with oxygen can take place, it is necessary that the former should be raised to a high degree of temperature. Were this not the case, we should have almost every substance burning, even at the ordinary temperature of the atmosphere; our Wallsend coals would burn without being put on the fire; candles would ignite of themselves; and a thousand other inconveniences of a similar kind would be continually occurring. We see the advantage therefore of this law of nature, that in general a combustible will not burn until it is raised to a high degree of temperature. Phosphorus, it is true, will slowly consume at the ordinary temperature of the air, and it is for this reason

Digitized by Google

that chemists are obliged to keep it in water; but even in this case it is necessary to add a considerable degree of heat, if we wish the combustion to be rapid and brilliant. We may illustrate what we have been stating by reference to the manner in which an ordinary candle burns. When we light the wick it melts the tallow immediately around the part, and forms a cup which retains a quantity of melted tallow; this is drawn up the wick, towards the ignited part, by capillary attraction, and entering into the flame in a gaseous state, (the additional heat it receives in its passage upward having caused it to assume that form), it soon becomes white hot, combining with the oxygen of the air immediately in contact with it, and forming carbonic acid, as described in our last paper on this subject. Now if, instead of using a candle with a wick of the ordinary size, we employ one with only a single thread of cotton, we shall be able to prove that whatever lowers the temperature of the intensely heated particles of tallow destroys the flame. This was an experiment of Sir Humphrey Davy's, when prosecuting his enquiries into the best mode of preventing accidents from the explosion of fire-damp. He found on bringing a cold good conducting substance in contact with the flame of a wax taper, having only a single thread of cotton for a wick, that it immediately extinguished the flame. He afterwards made a little circle of iron-wire, just sufficient to pass down the wick and closely surround it; when he passed this over the wick, in the flame, he found that while the wire was cold it immediately extinguished the flame as in the former instance; but he found that if he warmed the wire first in the flame, that it might be passed over the wick without putting out the light. The explanation of this circumstance is very simple: while the wire is cold it conducts away the heat from the flame very fast, so much so indeed that the particles of melted tallow are not sufficiently hot to enter into combination with the oxygen of the air, but when the wire is warmed it does not do this, and consequently the flame continues. The safety of the Davy lamp, (a full description of which will be found in our last Volume), depends on the cooling power of the wire that surrounds the light. Sir Humphrey Davy found that a piece of iron gauze wire held over the flame of a candle would not suffer it to pass through; it cooled the gaseous particles of the tallow so much in their passage, that they could not burn on the other side, and this was the case with the flame produced from the ignition of carburetted hydrogon—the fire-damp of miners. Davy found that although that portion which entered the lamp through the wire would burn with great brilliancy within, that the wire gauze prevented its communicating to the gas without, and thus the danger of explosion was provided against.

It sometimes happens that ships when out at sea suddenly take fire without any one at the time being able to explain the cause. It is frequently in consequence of the iron pyrites, mixed with the coals that the ship carries, becoming much heated by the decomposition of the water that may be mixed with it, and oxygen being present, combustion takes place. In the same way, and from the same cause, stacks of peat sometimes ignite spontaneously. In all cases of this kind, however, it is absolutely essential that the combustible should be raised to a high degree of temperature, and that oxygen should be present; these are the essentials necessary for combustion, and whenever they are provided it ensues.

There are some curious instances on record of what has been termed "spontaneous combustion." Several cases are reported in the scientific journals, supported by evidence that cannot be questioned, of persons who have been discovered at various times with their bodies partially consumed, although the furniture of the rooms in which they were found remained uninjured. The burning of the bodies was accompanied with a slightly unpleasant smell; and a pale blue flame was observed, similar to that of phosphorus when consuming slowly. The cause of this phenomenon is not well understood. It has been ascertained that the persons who died in this way were generally addicted to the use of alcohol, in some form or other, and it is supposed that the fluids and tissues of the body at last became so thoroughly impregnated with it, that they readily consumed when from some accident a portion came in contact with fire. This is a visionary hypothesis, but is accepted for want of a better; whether it be correct or not, however, the spontaneous combustion of animal bodies in the way described, is certainly a most extraordinary phenomenon and deserves attentive consideration.

RUB a stick of sealing-wax against dark cloth, apply it to the knuckle, and a spark will be produced.

Digitized by Google

## CURIOUS CHEMICAL EXPERIMENTS.

Into a very small brass cannon put a *little* fulminating silver, prime, and fire; it will go off with a report loud in proportion to the quantity used; and metallic silver will be found encrusted on a piece of glass, which should be set in a stand near, and opposite the muzzle of the gun. Fulminating silver may be purchased at most operative chemists. It explodes with percussion.

By means of a blowpipe, force a strong flame upon a piece of metal (except platina) not larger than a peppercorn, in an excavated piece of charcoal, for about twenty minutes, and the substance grows red, white, and gases. If a piece of nitre be applied to the metal whilst red hot, it is thus purified.

Apply a piece of platina and any gilt article in contact to the tongue, and a very curious sensation will be produced.

In a glass tube, open at both ends, fix two good red-waxed corks, having previously filled it with water; fix a pin in at one end, and at the other end a pin also communicating with a small cannon loaded with fulminating silver; if a leyden phial, charged from a conductor, be applied to the pin at the opposite end to the gun, it will fire.

Load a small cannon with fulminating silver, and apply a charged leyden phial to the touch-hole, and it will fire.

Upon a piece of wood let fall a drop of water, and add a grain or so of solid phosphorus; apply a piece of metallic potassium, and the phosphorus will inflame.

F.

## INSTITUTIONS.

*March* 27, 1838.—A lecture was delivered at this Institution, by Robert Carr Woods, Esq., member of the Meteorological Society, &c., on subjects of meteorological speculation and research. Mr. Woods, in taking a retrospective glance at the *philosophy* of past ages, remarked it exhibited a humbling picture of our philosophy in the present day, ever aiming at a *knowledge* of truth, but often falling short of attaining it; yet he said the intrinsic value of truth was such, as had in it sufficient to excite to our discovery of the treasure, whether it regarded religion, literature, or the sciences. The knowledge of first principles resting upon correct data, was the basis of every science; and in no branch ought this to be more fully carried out than in the entertaining and useful, but difficult science of meteorology. Before entering upon the phenomena around us, we should consider the phenomenon of the earth on which we dwell—its properties, construction, and use, and proceed, step by step, until we attained the summit of celestial phenomena. The lecturer then took a comprehensive view of the statements of philosophers respecting natural phenomena, from the dawning of philosophy in the Chaldean empire to the theorists of the present day, "whose opinions" he remarked, "were more numerous than their languages, and whose speculations were as opposite as the poles."

The distinguished lecturer said he was glad that astrometeorologia was now revived, and pursued with greater avidity than ever; "he could not but believe that every star in the firmament had its use, and the track of every comet was marked out by the Ruler and Governor of all for good." He then ably refuted the opinions and arguments of a writer in the *Monthly Chronicle*, who asserts, the planets do not exercise any influence on our atmosphere.

In conclusion, he urged upon his numerous audience the necessity of personal observation of the passing phenomena, and comparing their observations with each other, in doing which, each would contribute his part in rearing the building whose foundation was truth, and its pillars experience.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery lane.—Wednesday, April 11, R. Adams, Esq., on Acoustics, at half-past eight o'clock.

*Aldersgate-street Institution.*—Wednesday, April 11, J. S. Knowles, Esq., on the Greek Drama, at eight o'clock.

*Islington Literary and Scientific Society.*—Thursday, April 12, Dr. Matthew Freeman, on the Comparative Physiology of the Muscles, at eight o'clock.

*Poplar Institution*, East India Road.—Tuesday, 10, Mr. Francis, on Galvanism, at eight o'clock.

*Western Literary and Scientific Institution*, Leicester-square,—Thursday, April 12, Mr, Holm, on Phrenology, at half-past eight o'clock.

*Westminster Mechanics' Institution.*—Thursday, April 12, Basil Montague, Esq., on Laughter, at half-past eight.

*Tower-street Mutual Instruction Society*, 16, Great Tower-street.—Monday, April 9, Mr. Davenport, on the Social System.

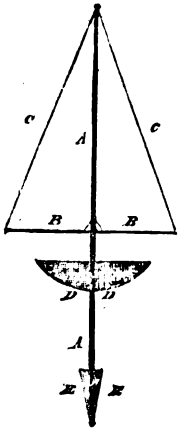
*Finsbury Mutual Instruction Society.*—Tuesday, April 10, Mr. Birt, on Terrestrial Heat, at half-past eight o'clock.

*St. Pancras Literary and Scientific Institution*, Colosseum House, New Road.—Tuesday, April 10, Dr. Walker, on Comparative Anatomy.

*Hall of Science*, Commercial Place, City Road.—Thursday, April 12, W. H. White, M. B. S., on Meteorology, at half-past eight.—Monday evening, at half-past eight, J. C. Coombe, on Chemistry.

Digitized by Google

## ANSWERS TO QUERIES.




Sir,—I beg to inform "H. L. N." (by means of the annexed diagram) the method of Drilling Holes in Glass and China:—

A. A. is a small iron rod, about one foot long, and one-eighth of an inch thick, with a hole at the top large enough to allow a piece of whipcord to go through; B. B., a piece of wood, six or seven inches long, with a hole in the middle to allow the iron rod to run through; C. C., a piece of whip-cord, run through the iron at the top, and fastened at the end of the piece of wood B. B. as above; D. D. a piece of lead, a quarter of a pound weight, in the above shape, run on the iron; E. E. a small piece of tin, with a diamond at the end, and worked up and down the same way as drilling a hole in iron.—Should there be any thing that "H. L. N." does not understand in the above, I shall feel most happy in showing him.

31, Hatton Wall, Hatton Garden. FRED. PERSENT.

Sir,—The following is an answer to "J. C. Junior's" Query in No. 77. The earth, in describing an ellipsis round the sun, is farther from that luminary at one extremity of its orbit than at the other, in consequence of the sun remaining stationary at the distance of 1,377,000 miles from the middle point of the longer axis of the ellipsis. Therefore when the earth is at Cancer, (Midsummer) it is double that distance farther removed from the sun than when at Capricorn (midwinter), the sun remaining stationary in the lower focus of the ellipse. The difference between its relative distance from the sun at the two points is 2,754,000, bearing about the same proportion to the whole diameter of the ellipse, as 17 does to 1000.—The Society of Arts meet at John-street, Adelphi, every Wednesday evening at eight o'clock. W. HOTINE.

## QUERIES.

Sir,—I shall feel greatly obliged to any of your Correspondents who could give me some particulars of the method of working embroidery and Berlin work. W. HOTINE.

Sir,—I wish to be informed how I can melt flint glass, to enable me to run it in different forms, as tobacco-stoppers, &c.; and whether it is necessary to add anything to keep the colour bright? I have tried a melting-pot on a strong coke fire, but that caused the metal to run. THOMAS JONES.

Sir,—I should feel obliged if I could be informed how tea or table-spoons are made, whether cast or stamped; and, the cheapest place to buy the moulds for the same? JOHN ENCOCK.

Sir,—I was much pleased with your intelligent Correspondent "Dr. Watts'" instructions for making Oil Gas; but should esteem it a favour if he would take the trouble to communicate through the medium of your valuable Publication, the probable cost of an apparatus proper for trying the experiment on a small scale, and where such an apparatus may be purchased —and will "Dr. Watts" please to inform me what kind of "volatile oil" is emitted in the process, and how it is to be separated from the acid which comes over with it—and to what purposes are both applicable? Also, how is Oil Gas condensed into cylinders for portable purposes, and is there any danger attending the process? and what might be the probable cost of such gas compared with the common coal gas?

F. N.

[No. 66, contains a description of the method adopted by the Portable Gas Company for forcing gas into cylinders.]

Sir,—I should feel obliged if any of your Correspondents could inform me how a small apparatus could be made which would produce sufficient sparks to fill a Leyden jar to carry in the pocket. I have heard of a small machine made to carry in the pocke, but have never seen one. E. M. G.

Sir,—I should be obliged if any of your Correspondents could inform me of the composition used in blacking the conductors of electrical machines; as I have one made of tin, and want to know how to black it. W. E.

Sir,—Can any of your Readers inform me where to purchase a small electric machine, or if any of your readers have one to dispose of, will they let me know, through the medium of your Magazine, what price and size it is, and where to be seen? Also, where to buy the "tubing" and "stopcock," mentioned in No. 56, and what cement is used? J. JESSUP.

[Our Correspondent can purchase the Tubing at Dymonds and Co.'s, Chemists, 146, Holborn Bars; with everything else he may want.]

Sir,—Can any of the Readers of your valuable work inform me of an easy and practical mode of whitening or bleaching common Bees Wax? F. W.

[White Wax is Bees Wax after it has undergone the process of bleaching. It is bleached by melting it at a gentle heat, and while fluid running it off in a small stream into a tub of water; it is afterwards exposed to the air and sun; these processes are repeated as long as the Wax retains any of its yellow colour. Lately, chlorine has been used for the purpose.]

Sir,—I feel greatly obliged to your Correspondent "Fred. Clark," for the information he has given me, and should be most happy if he would meet me at any place, or time, he may please to name, after five o'clock P.M., as I wish to speak to him on subjects of the greatest importance. JOHN EDWARD GODDARD.

## TO CORRESPONDENTS.

*The plan proposed by* M. T. N. *of lowering a large tarpauling over that part of the bed of the river Thames where the operation of the workmen are being carried on for the Tunnel is not original; it was adopted, we believe, after the first irruption.*

Vanderkiste's, *Cursory Remarks on Firing have been received.*

An Operative, *who complains of the uselessness of establishing a National School of Design, for the benefit of the working classes, while they are obliged to toil so many hours in the day, must recollect that this is the commencement of a new era. Twenty years ago, no arguments that could have been adduced in favour of the mechanic, would have brought forward such a number of wealthy and talented individuals in their behalf, as lately appeared on the platform at Exeter Hall, (the report of which is given in Nos. 70 and 71 of our Magazine). We have no doubt, therefore, that, ere long, some proposition will be brought forward by the very same individuals for reducing the hours of labour of the working man; seeing that the stability of a state depends mainly on the education and happiness of the people.*

W. Hotine. *The paper alluded to has only been postponed in consequence of the press of Correspondence already received by us. The particulars of his newly-invented Gun shall be inserted when the paper is sent.*

J. S. N.'s *Answer to* J. C. Junr.'s *Question shall be inserted next week.*

*Received* Tyro Lock's *Solution of* Q. E. D.'s *Question —Also* T. L.—L.—Walter, &c.

London: Printed at the Holloway Press, by D. A. DOUDNEY; where all Communications are to be addressed (post paid); published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

Digitized by Google

# THE PENNY MECHANIC,

## AND THE CHEMIST.

No. LXXX.] APRIL 14, 1838. [Vol. II.


### PYROMETERS.

FIG. I.

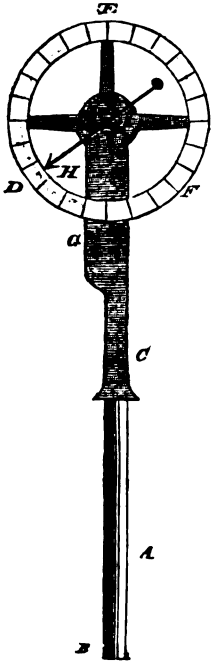
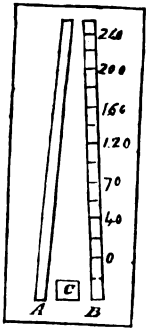
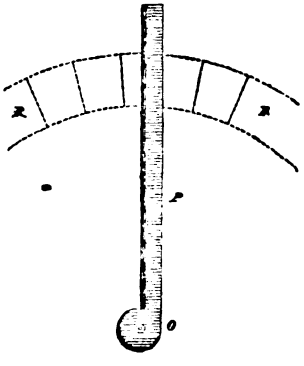



FIG. II.




### DRAWING INSTRUMENT.

FIG. III.





Vol. II.—No. LXXX. Holloway Press: D. A. Doudney



Digitized by Google

## PYROMETERS.

(See Figs. I. and II. front page.)

*To the Editor of the Penny Mechanic.*

Many are in the custom of judging of intense heat by the appearance of the object. Thus we have a dull red, a bright red, a white, and a full white heat. Sir Isaac Newton used to determine the heat by the rate of cooling, assuming that bodies lose caloric in proportion to the excess of their temperature above that of the surrounding medium. These methods, however, gave very imperfect indications of temperature; instruments have therefore been invented for measuring it, which are called *pyrometers*. That long in use for this purpose was invented by Wedgwood. Pure clay, and the earthy bodies in which it predominates, have the remarkable property of contracting instead of expanding by heat; and as the contraction is permanent, Mr. Wedgwood conceived that by measuring it, it would prove an indication of the heat to which the clay had been subjected. His pyrometer consisted of two brass bars, fig. 1, A B, fixed on a plate of metal, the space between them being smaller at one end than the other. They are divided into 240°, corresponding to 31200 of Fahrenheits' scale, so that each degree of the former, is equal to 130 of the latter, and the beginning corresponds with 1077. In finding the degrees of the thermometer equivalent to those of the pyrometer, we must multiply by 130, and then add 1077. This 60 of Wedgwood is equal to 8877 of Fahrenheit.

$$(60 - 130 = 7800 + 1077 = 8877.)$$

In reducing those of Fahrenheit to those of Wedgwood, we have first to subtract 1077, and divide by 130, thus 9657 Fahrenheit = 66 Wedgwood.

$$(9857 - 1077 = \frac{8580}{130} = 66.)$$

The substance used is a piece of clay made just to enter at the wide end between the bars C; to ascertain the temperature of any object, suppose fire, it is put into a crucible and exposed to it for some time, and when cold it is pushed as far as it will go between the bars; suppose it stops at 69, it shows that it has been subject to a heat of 8877 of Fahrenheit. It was at first imagined that this would be of great utility in ascertaining high temperatures; from the difficulties however of procuring clay of uniform contractile power it is not much used, besides it is liable to one great objection; if the clay be exposed to a moderate heat for a long time it will contract nearly as much as when heated intensely, it is necessary therefore to bring it as quickly as possible to the same temperature as the fire.

Another instrument now much employed, is that recommended by Daniell, fig. 2. It consists of a tube of black-lead A, shut at B, but open at C. When it is fixed to a brass tube there is a bar of platinum in it rivetted at B, and at C having a small platinum wire passing from it to the axis of the wheel D E F, and attached to a slight spring G H. The wheel D E F is connected with another, which has fixed to it an index, so that when the tube is heated the platinum expands and moves on. On the wheel is a scale containing 360 divisions, each of which is equal to 7 Fahrenheit, so that the degree unheated by the Pyrometer must be multiplied by 7, and it gives the corresponding one of Fahrenheit. Thus tin melts at 92 of D., which multiplied by 7 = 644 F.

J. R. Watts.

## ON THE EARTH'S ORBIT.

ANSWER TO J. C.

*To the Editor of the Penny Mechanic.*

Sir,—I take the liberty of answering "J. C. Junr.'s" third query, as stated in No. 77.

The reason of the sun's not being equidistant from both the extremities of the ellipse described by the earth, is the very circumstance of an ellipse being described at all. The fact of the earth and the sun being a greater distance apart at one period of the year than at another, was long known to astronomers; but, unwilling to believe that any other than circular motion could exist in nature, they endeavoured to account for this fact by asserting, that the revolving body moved round an imaginary point, which was either stationary at a short distance from the fixed body, or performed a small revolution around it. This curve was in the former instance called an eccentric, and the latter an epicyle, and the doctrine was embraced both by Ptolemists and Copernicans.

Kepler was the first who advocated the cause of truth, by proclaiming that the orbits of planetary bodies are in every case ellipses, having the sun, or the primary, in one of the two points called its focuses. The planets also move with different degrees of velocity in different parts of their orbits; the law which regulates their velocity being, that they describe equal areas in equal times. It was reserved for Newton to carry out this

Digitized by Google

important discovery. He showed that all motion is naturally in a straight line, when the impelling force is undisturbed; but if a body be acted on by two forces in different directions, it will not obey either, but move in a line between the impulsive direction of both. If one force tend to set a body in motion regularly, and the other increase or diminish in its power, the revolving body will describe a curve.

Now suppose the earth at its formation to have been launched forward with a regular projectile force, and to continue in a direct line till it comes within the sphere of the sun's attraction. This attraction would then draw it aside from its course, and were the projectile and the centripetal forces so proportioned, that the direction of the earth's motion when it first begins to fall towards the sun, would form exactly a right angle with the radius vector, it would continue its motion so as always to form a right angle, and consequently revolve in a circle, having the sun for its centre. But the centripetal force acts at first in a greater proportion than this, and the angle of the direction with the radius vector is less than a right angle, and therefore the projectile force actually reinforces the centripetal in drawing down the earth in its orbit nearer and nearer to the sun, till it arrives at a certain point where the orbit and the radius vector form a right angle. Immediately after passing this point, the angle is greater than a right angle, and the projectile force consequently impels it more and more out of the direction of the circle, and further from the sun, till it again arrives at a point where the orbit and the radius vector form a right angle, there to recommence its course as before.

This is not merely a theoretical speculation adapted to meet the exigency of the occasion, but sound reasoning, that may be plainly demonstrated by mechanism properly constructed.

The earth is at its perihelion or nearest distance to the sun about the 30th December, and at its aphelion, or furthest distance, about the 30th of June. The apparent diameter of the sun is in the former case about 32′ 35″, and in the latter about 31½′. It must not be forgotten, that the earth's orbit is liable to small perturbations, occasioned by the attraction of the planets which it may pass in the course of its revolution. Similar reasoning holds good with respect to all the primary and secondary planets, the comets, and the sun himself. Strictly speaking, it is not the sun which is the centre of attraction, but the common centre of gravity of the sun and the solar system. The numerous irregularities that occur, are so far from being imperfections that they are necessary for the stability and a lasting example of that beauty, order, and harmony, that pervades the universe.

With my best wishes for the success of your publication,

I remain, Mr. Editor, yours, &c.

J. S. N.

Southwark Astronomical Society,
April 7, 1838.

## MUSICAL BAROMETER, &c.

*To the Editor of the Penny Mechanic.*

Sir,—Some weeks ago, there appeared in your Magazine, an engraving purporting to show the effective power of a steam-engine in different positions of the crank. The writer, in his explanation, assumed the effective power to be proportional to the *angle* of the crank, (instead of the *sine* of that angle), in contradiction to a principle which must be self-evident to any person capable of thinking upon the subject, and which is taught in *all* the works which treat upon this elementary matter. He also stated that when two cranks were placed at right angles to each other on the same axis, the effective power would be equal in all positions; an absurdity which must be apparent to every one who has directed his attention profitably to this subject. The same writer also affirmed, that the combined force of two engines of fifty-horse power, amounted only to the power of fifty horses; these, and other equally ridiculous notions, convinced me that "Mr. Mathews was not *in any degree* enlightened upon the subject which he pretended to explain. I did not however interfere, till another correspondent called upon "Mr. M." to explain whether he considered two to be equal to one-half, or two-thirds? I then, with the avowed intention of preventing so preposterous a discussion, called the attention of "the parties," (meaning Mr. M.) to such simple principles, as would, if he had been capable of understanding them, have convinced him of the grossness of his error. This desirable result, I have not however effected; therefore, with the utmost respect to which he is entitled, I leave "Mr. Matthews" and his epistle, and proceed to the more agreeable task of adding a few observations on the notice of a

MUSICAL BAROMETER,

(In the same No. 74.)

If an iron wire, (or any other elastic

Digitized by Google

substance) be stretched tight between two fixed points, and the strings of a pianoforte, and then be forced from its rectilinear position by the action of any force, the string will thereby be lengthened; and when that force ceases to act, it will return to its original position, with a velocity proportional to the elastic force of the string, directly, and its inertia inversely; and it will continue to vibrate isochronally, until external impediments destroy its motion, communicating similar vibrations to the air, which, acting upon the *tympanum* of the ear, produce the sensation of sound; and the sound is grave or acute, according to the number of vibrations produced in a given time; the slow vibrations producing the grave sounds, and the quick ones the acute. Now if any vibrating string, of equal thickness throughout its whole length, be divided into two equal parts by means of a fulcrum placed in the centre, each of those parts will vibrate with double the velocity of the whole string; and every second vibration of the half, coinciding with the vibration of the whole length, produces that harmonious sensation, which, in music, is termed an *octave*; also, if the string be divided into 3, 4, 5, and 6 equal parts, the vibrations of those parts will respectively produce the harmonious sounds which, in music, are represented by the signs, G, c, e, g; forming the fifth, fourth, major third, and minor third; the tonic or fundamental, being C; from these simple elements the whole science of harmony is derived. It would exceed the convenient limits of this article, and is not essential to my present purpose, to describe the various causes which produce the secondary vibrations of a sonorous string; but it must be observed that all vibrating strings, do vibrate simultaneously in their whole length, and in their *aliquot* parts: and the latter vibrations are more or less apparent, according to the strength of the string, and the circumstances which excite them. If an iron bar, or thick wire, (the thicker the better, provided sufficient force can be obtained to draw it tight enough) eighty or one hundred feet in length be so fixed that it may be stretched with the utmost force it will support, a variety of harmonious sounds will be produced by the vibrations excited by the action of the wind; when the wind is very strong, the harmonic nodes are too far apart to produce an audible effect; but when a gentle breeze plays equally upon the whole length, the harmony is inconceivably fine; at other times, conflicting sounds will proceed from different parts, causing the most discordant perturbation at their meeting; but the effect is agreeable in the extreme, when this discord resolves itself into the delightful harmony of equal and harmonic undulations. The instrument described in Number 74, appears to me to be no more than a modification of this experiment. It is not clearly shown that it indicates the pressure of the atmosphere, and the speculations upon the cause of the phenomenon are only given as conjecture; I therefore prefer the explanation which attributes the effect to a cause which is known to be adequate.

Two or three years ago, a remarkable natural barometer was discovered near a place called Salenche, in Savoy. A person, desirous of procuring water near his dwelling, caused a very deep well to be sunk; but finding no water, after much perseverance he was compelled to abandon his project, and the dry well remained covered over with boards. One day, while standing near the spot, he heard a noise proceeding from the well, which sounded like the gushing of subterraneous water; upon approaching the well, he was surprised to perceive a strong current of air issuing from between the boards; this continued for some time, and then gradually subsided, till all was silent again. After this, he frequently visited the well, and observed sometimes the same phenomenon, and sometimes the contrary, the air rushing into the well from above. In the course of time, he remarked, that whenever the barometer fell, there was a current of air proceeding from the well; and when the barometer rose, there was a current descending into it, and no alteration took place in the barometer, without a corresponding effect in the well. Various conjectures were resorted to, in order to account for this singular phenomenon; I shall only mention my own, which indeed was ultimately adopted, almost unanimously as the true explanation.

In the mountainous regions which extend northwards from the Alps, through Savoy, Switzerland, and a part of France, subterranean caverns, some of them of very great magnitude, are found in almost every part; their general appearance seems to indicate that they have, at some time, been receptacles of water; some of them exhibit gushing torrents, and others, silent and apparently motionless lakes of clear water, hundreds, and even thousands of feet beneath the surface of the ground above them. There is one at Valorbe called "la grotte aux fées," or the faries grotto. (This is a sequestered spot on the

Digitized by Google

Jura; a country which deserves more attention than it receives from the geologist, the botanist, the admirer of magnificent scenery, and the lover of nature in her most awful grandeur, and most solemn privacy). The entrance to this cavern, is on the side of a steep mountain, and difficult of access; the opening is at first so small, that a person cannot pass without bending considerably; but this narrow passage soon terminates in a spacious chamber, from which a more lofty corridor leads on to another chamber of still greater dimensions; and so on through a long suite of apartments to the last, in the roof of which is a conical aperture about the shape and size of the tallest chimnies which are used in manufactories where great furnaces are required. A peasant of the country told me that formerly, the day-light might be seen from below; but it is now closed on the top, some accidents having happened to the cattle grazing above. There is no water in this cavern, except a dropping spring near the extremity, under which is a frightful abyss, down which "Q. E. D." would have fallen, had not a friend caught him, I scarcely know how. Some of the chambers are as big as the great room at Highbury Barn Tavern; and the length from entrance to terminus, about 300 yards;—I give these dimensions from recollection only, as it did not occur to me at the time to take any measurement. Now conceive a cavern of this description to be situated in the vicinity of the well; if a communication were effected through any fissure in the soil, from the cavern to the well, and there were no other considerable outlet, a barometer would be formed indicating every *change* in the atmospheric pressure; for if the pressure of the atmosphere be so increased as to force the column of mercury higher up into the tube of the barometer, it will also press upon the air contained in the well, and force it into the cavern; and it will continue to flow in, till the whole mass of air contained therein is so condensed as to support, by its elastic force, the pressure of the incumbent column above; and when the pressure is again diminished, so as to allow the mercury to descend by the superior force of its gravity, the elastic force of the air in the cavern will cause it to expand, throwing out the superabundant quantity through the aperture in the well; and this current will continue to flow, till equilibrium is again restored between the external pressure, and the internal expansive force. The chief argument against this hypothesis, is, that these caverns are usually found with an opening for entrance, and another for the exit, supposing them to have been originally receptacles of water; there are however many casual circumstances which might close these apertures. I must defer to another occasion the description of a *musical thermometer*, which I constructed some time ago, and which performs with tolerable precision, so that a blind person may ascertain the temperature, at any time, at least within two or three degrees.

Your obedient Servant,

Q. E. D.

## INSTRUMENT FOR DRAWING THE BRICK-WORK AND KEY-STONES OF ARCHES.

(See Fig. III. front page)

*To the Editor of the Penny Mechanic.*

SIR,—I send you a description of my contrivance for drawing the bricks, key-stones, &c., of arches with facility, which may be useful to some of your readers. It consists, simply, of a thin piece of ebony, ivory, or metal, as shown in the drawing. A middle point is fixed in the centre, O, and the edge, P, is to be champhered off. The only rule to be minded in making it, is to have the edge, P, in a line with the centre, O. Fix the needle point in the centre of the arch, B, and then the working is obvious. I have made one which quite answers my expectation.

I remain, Sir, yours, &c.

FORMATOR.

P.S. It might be greatly improved by the addition of a sector or a protractor, by which the bricks, &c., can be drawn to any angle.

*Society for Promoting Practical Design, St. Martin's-street, Pall Mall East.*—The first lecture of this institution, was delivered by James Elmes, Esq., C. E., on the 18th ultimo, on the Connexion and Comparison of Science, Literature, and the Fine Arts, Hyde Clarke, Esq., C. E., in the chair. In a lecture of deep research, Mr. Elmes particularly alluded to the mathematics as an instrument connecting all branches of knowledge,—the arguments of the philosopher, the harangues of the rhetorician, and the labours of the architect, and civil engineer.—On the 20th, Mr. Claxton delivered a lecture on pneumatics, and alluded to the superior opportunities which mechanics have over professional men, in acquiring knowledge.—On the 22d, B. R. Langdon, Esq., gave a lecture on horn.—*Railway Magazine.*

Digitized by Google

# THE CHEMIST.

## HYDROCYANIC ACID.

Hydrocyanic acid was discovered by Scheel in the year 1782; the substance which he prepared was merely a solution of the acid in water. Gay Lussac first procured it in a pure state, and was enabled to determine its real nature by the discovery of cyanogen. It is found prepared by the hand of Nature in the leaves of the cherry laurel and peach, in the blossoms and seeds of the peach, the apricot, the bitter almond, the cherry laurel, and several other plants. The distilled water and essential oil of these vegetable substances yield hydrocyanic acid; but it is doubtful whether the acid be ready formed in these substances, or whether it is the result of the operation for procuring it by a new combination of its ultimate constituents, carbon, nitrogen, and hydrogen.

Pure hydrocyanic acid is artificially prepared by heating one equivalent of dry bicyanide of mercury in a glass retort, with two equivalents of hydrochloric acid. The two equivalents of cyanogen of the bicyanide of mercury combine with the two of hydrogen of the hydrochloric acid to form hydrocyanic acid; and the two equivalents of chlorine of the decomposed hydrochloric acid unite with the mercury, forming bichloride of mercury. The volatile prussic acid passes over in vapour with moisture and hydrochloric acid. It is deprived of hydrochloric acid, by passing it through a tube filled with fragments of marble, and then dried by transmission through another tube, over fragments of fused chloride of calcium, and is, lastly, collected in a clean dry tube surrounded by ice.

Vauquelin recommends the following process, which is elegant, easy of execution, and productive. Fill a narrow tube, placed horizontally, with small particles of dry bicyanide of mercury, and pass a stream of dry hydrosulphuric acid gas along it. The moment that they come in contact, double decomposition ensues, and hydrocyanic acid and bisulphuret of mercury are formed. Stop the process as soon as the whole has become black, then expel the hydrocyanic acid by a gentle heat, and collect it in a cool receiver.

Pure hydrocyanic acid is liquid, limpid, and colourless. It has an acrid, pungent taste, and a very peculiar odour, resembling peach blossoms. When applied to the tongue, at first it produces a sensation of coolness, which is soon followed by heat. It is very volatile. Its specific gravity is 0.7058. It boils at 80°, and freezes at 5°. When a drop is placed on a piece of glass, it evaporates so rapidly as to congeal it. It unites with water and alcohol in every proportion.

Pure hydrocyanic acid is so exceedingly poisonous, that a single drop placed on the tongue of a dog causes death in a very few seconds, and small animals, when confined in its vapour, are rapidly destroyed. Diffusible stimulants best counteract its effects, of which the solution of ammonia is most beneficial. The aqueous solution of chlorine acts as an antidote, by decomposing the hydrocyanic acid and forming hydrochloric. In the experiments of MM. Persoz and Nonat, the poisonous symptoms induced by the acid applied to the globe of the eye, disappeared on administering chlorine internally. From this it appears, that both substances are absorbed into the circulating fluids, and there react on each other. Pure hydrocyanic acid is so susceptible of decomposition, that it sometimes spoils within an hour after it is made; and it can rarely be preserved two weeks. It may be kept longer if diluted with water, but it will even then undergo gradual decomposition. It is not acid to the taste, slightly reddens litmus paper, does not decompose the salts of carbonic acid, and is unable to neutralize potassa. Hydrocyanic acid is resolved by galvanism into hydrogen and cyanogen; the former appearing at the negative, and the latter at the positive pole. Its vapour is inflammable, burning with a blue flame, and with oxygen gas it forms a mixture which explodes with the electric spark.

In combination with water, it forms the acid discovered by Scheel, and which we generally find in the apothecary's shop. There are several processes for obtaining the medicinal acid of uniform strength, a few of which I shall endeavour to describe.

1. One very simple method, that of M. Proust, consists in passing a stream of hydrosulphuric acid gas through a solution of bicyanide of mercury, until sulphuret of mercury ceases to be precipitated. The excess of acid may be removed by agitation with carbonate of lead, after which filter the solution. It is doubtful whether the acid thus obtained is uniform.

2. Mr. Everitt recommends it to be prepared extemporaneously, according to the following, and which is introduced into the London Pharmacopœia:—Take "48½ grains of cyanide of silver, added to a fluid ounce of distilled water, mixed with thirty-nine grains and a half of hydro-

Digitized by Google

chloric acid; shake all these in a well-stopped vial, and after a short interval pour off the clear liquor into another vessel."

3. Dissolve five drachms of powdered ferrocyanide of potassium in twenty drachms of water, then add fourteen drachms and a half of diluted sulphuric acid (composed of ten drachms of water, and four and a half of acid), and distil until the materials become thick or pasty; about thirty drachms of distilled acid are obtained (or if the quantity procured be less than this, water is to be added to make up the amount), which contains about 3.3 per cent. of real or an hydrous hydrocyanic acid. This process is recommended by Giese, who states that it may be preserved for many years. Dr. Christison, in his celebrated work on poisons, says, that it "may be kept for many years, even exposed to diffuse light, without being decomposed at all." This is probably owing to a small quantity of sulphuric acid which it contains.

4. Recommended by Dr. Clark:—"In 100 drachms of water are dissolved eight and a quarter of cyanuret of potassium, and with this is mixed a solution of 18¾ drachms of crystallized tartaric acid in 2) of water; and after the sparingly soluble bitartrate of potass has subsided, the solution is decanted for use." A little bitartrate of potassa is the only impurity.

Owing to the volatility of hydrocyanic acid, and its tendency to spontaneous decomposition, its quality is apt to vary; for this reason it should be prepared only in small quantities, preserved in well-stopped bottles, and excluded from the light. On account of the acid being of unequal strength, it is highly necessary that we should possess some method of ascertaining this point. Orfila suggests precipitation with nitrate of oxide of silver. The cyanuret, after being washed and moderately dried, consists of 108 of the dry silver and 26.39 of cyanogen, being an equivalent of each, and therefore 100 parts of the dry cyanuret correspond to 20.9 of real hydrocyanic acid. Dr. Ure proposes the following:—He agitates peroxide of mercury, reduced to a fine powder, in the acid to be tried, until no more be dissolved. On dividing the weight of the peroxide used by four, the quotient expresses the quantity of real acid contained in the diluted. The oxide should be added to the cold acid in small quantities at a time, avoiding an excess, which is known by the solution not changing the infusion of red cabbage to a green. The presence of free hydrocyanic acid may be recognized by its odour. Nitrate of silver throws down a white precipitate of cyanide of silver, which, when dried and heated, emits cyanogen gas, which is easily known by the beautiful rose-red colour of its flame. Sulphate of copper forms with hydrocyanic acid, if previously rendered alkaline with a little potash, a greenish precipitate, which becomes white on adding hydrochloric acid, owing to its dissolving some oxide of copper thrown down by the potash. If the acid is rendered alkaline by potash, green vitriol produces a greyish-green precipitate, which, on the addition of a little hydrochloric or sulphuric acids, becomes of a Prussian blue colour.

J. THOMPSON, JUN.

Clitheroe.

## CURIOUS CHEMICAL EXPERIMENTS.

SUSPEND a few threads of sewing cotton (wet) upon the conductor of an electrical machine, as described in a back number of the *Penny Mechanic*, revolve the cylinder, and if a piece of iron or steel, with a grain of fulminating silver upon it, be held under the cotton, sharp-pointed drops will fall, and being electrified, will ignite the powder, although the same phenomena would be perceived without their being electrified.

Charge a leyden phial from the conductor, and apply the ball to a brass wire going so far down a small house, &c., for the purpose, and if a little powder be in contact with the end of the wire inside the house, it will ignite.

Load a small cannon with fulminating silver, and apply a charged leyden phial to the touch-hole, and it will fire.

If a little fulminating silver on the blade of a penknife be applied to a conductor, it fulminates.

Take a leyden phial in the left hand, upside down; let the ball touch the conductor, and the fingers press the rubber; turn round the cylinder with the right hand, and if the fourth finger of the left hand be applied to the conductor now and then, a shock will be perceived.

N.B. A leyden phial may be bought cheap. F.

*To make a Black Ink from two colourless Fluids.*—Put into a glass a quantity of water, and add to it some tincture of galls; then put in a small quantity of a solution of sulphate of iron, and the whole will immediately turn black, and be nothing more or less than our *common writing ink*. R. H. N.

Digitized by Google

# INSTITUTIONS.

LECTURES DURING THE WEEK.

*Islington Philo-Scientific Society*, Camden-street, Islington Green.—April 19, Mr. J. F. Holdernesse, on the Moral Faculties, considered Phrenologically.

*St. Pancras Literary and Scientific Institution*, Colosseum House, New Road.—Tuesday, April 17, Mr. Burton, on the Manufacture of Iron and Steel.

*Tower-street Mutual Instruction Society*, 16, Great Tower-street.—Monday, April 16, Mr. Davidge, on the Influence of the Stage on the Morals of the People.

*London Mechanics' Institution*, Southampton-buildings, Chancery lane.—Wednesday, April 18, R. Adams, Esq., on Acoustics.—Friday, 20, F. B. Calvert, Esq., on the Poets of the Elizabethan age to the present, at half-past eight o'clock.

*Aldersgate-street Institution.*—Wednesday, April 18, J. S. Knowles, Esq., on the Greek Drama, at eight o'clock.

*Islington Literary and Scientific Society.*—Thursday, April 19, Dr. Tineman, on Digestion, at eight o'clock.

*Poplar Institution*, East India Road.—Tuesday, April 17, W. Houlder, Esq., on the Life and Times of Charles the First, at eight o'clock.

*Western Literary and Scientific Institution*, Leicester-square.—Thursday, April 19, Dr. Trueman, on Physiology, at half-past eight o'clock.

*Hammersmith Literary and Scientific Institution.*—Friday, April 20, R. Cull, Esq., on the Study of the Human Mind, at half-past eight o'clock.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—Will "Dr. Watts" have the kindness to inform me of the meaning of the word *Diastase*, as mentioned in the Penny Cyclopædia under the article "Brewing," where it is stated to "more abundantly change the starch into sugar." I wish to know the principle, and the manner of use. J. DOBELL.

[Glass Tubing and Platinum, can be bought at Diamonds', Holborn Bars.—The best Encyclopædia, is the Encyclopædia Britanica.]

Sir,—You will oblige me by inserting the following Queries:—Where can I purchase the Hydrogen Instantaneous Light mentioned in No. 58?—Where can I buy Glass Tubing and Platinum?—Would any of your Readers favour me with a description of the Microscope?—What is the price of the Chemical Manipulation, and Griffin's Chemical Recreations, and where are they sold?—Also, which is the cheapest and best Encyclopædia publishing or published?

K. T. Y.

## ANSWERS TO QUERIES.

*To prepare Fulminating Mercury.*—Sir,—As some of your Subscribers have requested to know the method of preparing Fulminating Mercury, I send you the following description, at the same time cautioning your readers that great danger is attending the use of it.—The discovery of fulminating mercury was made by Mr. Howard. It is as follows:—Dissolve 100 grains of murcury in an ounce and a half by measure of nitric acid, of the specific gravity of 1·5; add to the mixture two ounces by measure of alcohol, or pure spirit, and apply heat to the flask containing the mixture till it begins to boil; then remove the flask from the lamp. The action becomes violent, and continues for some time; a dense white smoke issues from the vessel, which is heavier than air. At first a little nitrate of mercury is deposited, but this is soon redissolved, the liquid becomes grey, from the reduction of a part of the oxide of mercury; after some time it becomes yellow, and crystals appear, which augment on cooling. They are of a greyish white, hard to the touch, and heavy. They are to be separated from the liquid by filtering; to be washed in pure water, and dried in a heat not exceeding 212°. By being dissolved and crystalized two or three times, they become brilliant, white and silky, and have a faint metallic lustre. It detonates if heated to upwards of 300°, by the blow of a hammer, by friction, and by electricity. It detonates if struck or agitated with glass rods; and therefore the greatest precaution is necessary, both in preparing and using it. When it detonates, its effects are very violent, but they do not extend far.

A. B.

*To make an Electrical Orrery.*—Sir,—Should the following description of the electrical orrery be of service to your Querist "K. V. Crofts" (in No. 73), it is at your service. Let a single wire, with its extremities pointed and turned, be nicely balanced on a point; fix a small glass ball over its centre, to represent the sun. At one extremity of the wire, let a small wire be soldered perpendicularly, and on this, balance another small wire with its ends pointed and turned, and having a small pith ball in its centre, to represent the earth, and a smaller ball of the same kind, at one of the angles for the moon. Let the whole be supported on the prime conductor, or on a glass pillar, and connected with the conductor; and when the machine is worked, the wires will turn round, the earth turning round the sun, while at the same time the moon revolves round the earth.

T. S. A.

## TO CORRESPONDENTS.

*A Correspondent (Z.) wishes to know our opinion, as to the number of hours each day it is possible, with propriety) to limit the time of labour?—Our opinion is, that the time of actual labour might be reduced to eight hours. This would give every man an opportunity of attending Mechanics' and other Institutions for the improvement of his mind; and also afford him ample time, during the Summer months, for rural walks, both for the benefit of his health and the study of botany, entomology, &c.—This, of course, must be a work of time; it must be seen by the higher classes, that to lessen the hours of labour of Mechanics will tend ultimately to make them a wiser, happier, and a better people. And note that there is such a superabundance of labour in the market, (caused by that powerful agent "Atmos,") and our fields still continue to pour forth abundant harvests,—enough for all, and to spare—we see no reason why the question should not be mooted.*

*We have to inform the numerous Subscribers who have been making inquiries as to the time of the completion of our Second Volume, that the Index is now being set in type, and a splendid Copper-plate Engraving of our Scientific Countryman Watt, intended as a frontispiece to the Volume, is at the Printer's. We expect, therefore, to be able to supply the Volume in a fortnight.*

Philo's *answer to* O. P. Q. *has been received.*

W. Wilkinson's *paper on the Crank has also been received.*

*Our Engraver has, unfortunately, lost the Letter containing the description and diagrams of* Mr. Goddard's Improved Floating Fire Engine.—*We should feel obliged if* Mr. G. *would favour us with another.*

Jean E•••g.—*We cannot find room in our Magazine for all the communications sent to us for insertion. For making Fire Works,* See Nos. 37, 38, 39.

*Received* S. T. A.—M.—Electoro—James.—C. J. R.—J. C. Junr.—A Well-wisher.—R. T. Y.—R. H. N.—Joseph Ward.—Electron.

## END OF VOL. II.

London: Printed by D. A. Doudney, Holloway Road.

Digitized by Google

# INDEX.


Absorbed gases, mode of collecting, 254.
Accidents in mines, 3.
Aerostation, 11, 27.
Affinity, 23.
Air-pumps, 51.
————, cheap, 75.
————, experiments with, 69.
Alarums, 2, 26.
Alexander Wilson, 44.
Amalgum of zinc, 79.
America, 282.
American expresses, 94.
Ancient eclipse, 253.
Answers to queries, 8, 16, 22, 32, 40, 48, 56, 64, 72, 80, 88, 96, 104, 112, 120, 128, 131, 136, 138, 144, 147, 152, 154, 160, 168, 172, 176, 184, 192, 200, 216, 229, 248, 256, 264, 280, 288, 296, 312, 320.
Antidotes for poisons, 55.
Antiquities of Tara Hill, 188.
Apology of Tyro Lock, 307,
Apparatus for making gases, 42.
———— to pass gases through liquids, 252.
Aquafortis, 175.
Argentine steel, 79.
Arithmetical question, 305.
Arnott's thermometer stove, 236, 277.
Arsenic, 181.
————, vegetation in, 62.
Ashmolean Society, 134.
Astronomical apparatus, 2.
Atmosphere, 103.
Automatic ship and sea, 298.

Balloons, plan for steering, 234, 261.
Bank-notes, method of wetting paper for, 277.
Barometer, extraordinary fall of, 215.
Barometers, musical, 278, 315.
Battery, Mullins', 287.
Biographical sketches, 12, 28, 38, 44, 156, 235, 304.
Blow-pipe, cheap, 157.
Botanical Society, 270.
Bow saws, 154.
Brick beam, experimental, 266.
Bridge across the Wear, 178.
Cabbage, red colour of, 231.
Cabiric mysteries, &c., 213.
Camphor, singular property of, 103.
Captain Back, 156.
Carbon, 245.
Carbonic acid, 191, 216.
Carriages which do not upset, 220.
Caution in making experiments, 308.
Cheap filtering-machine, 94.
Chemical affinity, 135.
———— tests, or re-agents, 95, 71, 111, 119, 127.
Chimneys, sweeping, 124, 156.
Chlorine, 160, 182.
Coach-drag, 74.
Coal, 45.
Colossal vegetables, 150.
Combination of the alphabet, 54.
Combustion, 158, 214, 227, 250, 285, 286, 309.
Condition of working classes, 13.
Conical valves of steam-engines, 10.
Copper, 222.
Crank, on the, 220, 258, 266, 271, 300, 307.
Cranks of steam-engine, 227.
Crystallized tin, 7.
Curious method of catching wolves, 94.
Cyanegen, 246.
Cylindrical rails, 172.

Damascus steel, 101.
Deafness, hearing cornets for, 290.
Deposit of salt from salt water, 62.
Derby silk mill, origin of, 110.
Descent of Garnerin's parachute, 4.
Destroying fire damp, 231.
Diamond, constitution of, 166.
Drops, Prince Rupert's, 16.

Earth's orbit, 314.
Easy method of breaking glass, 30.
———— to make golden figures, 30.
Eclipses, 117.
Electricity, 207, 215, 223, 262, 309.
Electrical apparatus, cheap, 58.
———— machines, 78, 230.
———— stool, 118, 207.


Digitized by Google

Electrical telegraph, 188, 219, 229, 240, 243, 269.
Electro magnetism, 218.
——— magnetic engine, 142, 218.
Electrometer, 223.
Elements, on the, 167, 190, 199, 202.
Elopements by steam, 8.
Engines of steam-boats, 26.
Enormous rope, 166.
Ethereal oil of wine, 79.
Expansion of solids, 142.
Experiments, apparatus for, 87.
————, interesting, 2, 86, 103, 111, 142, 159, 168, 181, 191, 230, 231, 278, 295, 311, 319.

Falling stars, 261.
——— stones, 174, 215.
Faraday, Dr., 235.
Figures on glass, how to engrave, 40.
Fire alarums, 219.
——, how to extinguish, 106.
—— produced by two cold liquids, 103.
—— staircase, 82, 106.
Fossils at Sausan, 216.
Fountain of fire, 143.
French polish, 79.
Fulminating powder, 103.

Galvanic apparatus, 10.
Galvanism, 6, 285.
Garden fountain, 230.
Gas, 174.
Glass manufacture, 70.
Gold, 246.
——, artificial, 79.
—— powder, 79.
—— shell, 79.
Gothic and Eliptic arches, 122.
Grand Junction Railway, 229.
Grinder's protector, 162.
Gun flints, 60.
Gunpowder engine, 189.

Hand-loom weavers, 60.
Heat, 108, 116, 125.
Herschell, 156.
Horse power, 18.
Horses running away, to prevent, 130.
Hodrocyanic acid, 318.
Hydrostatical paradox, 301.

Imitations of medals, &c., 7.
Immaterial capital, 29, 45, 52, 58.
Incombustible thatch, 223.
Indian-rubber solvent, 125.
——— steel wootz, 79.
Indigo, 62.
Injurious occupations, 43.
Inks, various, 15, 91, 166, 319.
Insects for specimens, 75.
Instantaneous production of curds and whey, 86.
Institutions, 279, 287, 311.
Instrument for drawing brick-work, &c., 317.
Iodine, 245.
Iron coffins, 53.
——, how to tin, 24.
——, manufacture of,
——, mould to remove, 191.
—— steamers, 54.
—— tree, 86.

Journals scientific 29.
Joyce's patent stove, 282.

Largest American and English ships, 46.
Laughing gas, 67.
Laws of chemical combination, 31, 39.
Lead, 199.
—— tree, 295.
Leap from a ship's mast, 150.
Lemonade, 86.
Levelling, 194, 202, 110, 226, 268, 283, 303.
Literary and Scientific Institution, 149.
Lithography, 174.
Locomotive-engines, 62, 170.
————, new, 300.

Machinery, 306.
Mechanical agents, 251, 259, 272.
———— problem, 194,
Mechanic's Institution, 8, 216.
———— Library, 36, 68, 207, 293.
Metallic silver, 191.
Metallurgy, 231.
Meteorogical Society, 173, 180, 206.
Method of warming rooms, 228.
Milton Institution, 126.
Mineral chamelion, 295.
———- springs of Ireland, 74.
Miscellanies, 94, 151, 174, 180, 183, 189, 197, 244.
Mould, formation of, 165.
Musk, artificial, 86.
Mutual Instruction Society, 165.

Natural History, 51.
New motive power, 304.
Nitrogen, 246.
Nitrous oxide, 222.

Oil gas, 278.
—— of laurel, 255.
—— of vitriol, 175.
On the study of mechanics, 83, 90, 98, 107, 115, 133, 154,
Oxy-hydrogen blow-pipe, 138.

Paddle-wheels, 260.
Paper staining, 139.
Parachutes, 4, 50, 66, 85, 111, 126.
Parallel rules for drawing, 42.
Patent yellow, 79.

Digitized by Google

Payne's floating coffer dam, 34.
Penmanship, 196.
Perpetual motion, 146, 170, 182.
Phosphuret of calcium, 295.
Pin making, 21.
Pleasing optical experiments, 94.
Pneumatics, 267.
———— experiment, 143.
———— trough, 103.
Pokerology, 300.
Polytechnic University, 91.
Portable gas-pump, 202.
Potassium, 263.
Potato brandy, 175.
Powder, boat accidents, 52.
Practical Design, Society for promoting, 238, 294, 317.
Printing press, new, 14.
Production of insects from silica, 76.
Pure vegetable oil, 132.
Pyrometers, 314.

Queries, 8, 16, 48, 56, 64, 72, 80, 88, 96, 104, 112, 120, 128, 136, 144, 152, 160, 168, 176, 184, 192, 200, 208, 232, 248, 256, 264, 279, 288, 296, 312, 323.

Railroads, 98, 150.
———— travelling, 148.
Railway, Durham and Sunderland, 220.
———, Great Western, 221, 163.
———, London and Birmingham, 19, 66, 92.
———, Southampton, 221, 308.
Rain gauge, 58.
Refined ox gall, 79.
Rein-deer, 88.
River steamers, 84.
Royal City medal, 174.

Safety-valve, 218.
Salt, 255.
School of Design, 277,
Scientific institutions, 157.
———— questions, 91, 290.
Sea fish in fresh water, 213.
Sea water, 162,
Shoemakers's rounding-knife, 282.
Silver tree, 86.
Singular discovery, 174.
Skaiters, 234.
Southwark Literary Society, 141.
———— Observatory, 100.
Steam and hand looms, 46.
Steam boats, expense of, 62.
———— engines, 26.
————, paddle-wheels for, 74, 109,
————, plan for warming, 106.
———— propeller, 189.
Steam boiler safety-valve, 138.
——— carriages, safeguard for, 194.
——— engine cranks, 227, 78.
————, new, 221.
————, power of the, 62.
Steam gun, 122.
———, nature and properties of, 178, 196, 207, 212, 250, 261, 272, 284, 293, 299.
——— power, 186.
———, ringing bells by, 294.
——— versus camels, 46,
Strikes, 123, 149, 173.
Stuffed animals, &c., 32, 139. 255.
Substances, simple, 15.
Sugar of lead, 151.
Sunken vessels, to raise, 109.

Tartaric acid, 143.
Telescope, 131.
Thermometers, 190, 250, 254.
Thunder-clouds, 151.
Timber measuring, 186, 241, 299.
Tin, 14.
Tubus calefactus, 179, 215.

Varnish for coloured drawings, 40.
Vegetables, preservation of, 167.
Vegetable substances, preservation of, 142.
Velocipede, 148.
Veneering, 54.
Vinous fermentation, 7.

Warming houses, 212.
Watch alarum, 90, 131.
———, electricity of, 159.
Water, 123, 140.
——— a bad conductor of heat, 231.
——— alarum, 259.
———, constitution of, 63.
———, effects of heat upon, 141.
——— gauge for steam-boilers, 154.
Wheel and pulley, 258.
——— of carriages, locking, 210.
White copper, 79.
——— wash varnish, 79.
Window-sash, improved. 58.
———— suspender, 147.

Digitized by Google

# LIST OF ILLUSTRATIONS.


1 FRONTISPIECE.
2 Cheap Astronomical Apparatus.
3 Curious experiment.
4 Alarum.
5 Cocking's Parachute.
6 Garnerin's Parachute.
7 Conical Valves.
8 Cheap Galvanic Apparatus.
9 First Class Engine (No. 1.) of the London and Birmingham Railway.
10 Steam Boat Engines.
11 Payne's Floating Coffer Dam.
12 Apparatus for Making and Collecting Gases.
13 Parallel Rules, for Drawing Perspective Lines.
14 Parachutes: Cocking's.—Garnerin's.—Parke's.—Wilson's.
15 Air Pump.
16 Wallington's Improved Window Sash.
17 Electric Bottle.
18 Rain Gauge.
19 Electric Apparatus.
20 London and Birmingham Railway Station, Euston-Square.
21 Upright Steam-Boat Paddle-Wheel.
22 Coach Drag.
23 Plummer's Plan for a Fire Staircase.
24 Watch Alarum.
25 Electrical Experiments.
26 Plan for Warming Steam-Boats
27 Parachutes.
28 Gothic and Elliptic Arches.
29 Paper Staining Machine.
30 Simple Oxy-Hydrogen Blow-Pipe.
31 Steam Boiler Safety-Valve.
32 Window Sash Suspender.
33 Perpetual Motion.
34 Water Gauge for Steam Boilers.
35 Bow Saws.
36 Grinders' Protector.
37 Railroad Engines.
38 Electrical Experiments.
39 Mathew's method of Calculating Steam Power.
40 Vaughan's Safeguard for Steam Carriages.
41 Portable Gas Pump.
42 Plan to Check the Speed of Horses.
43 Electro-Magnetism.
44 Electro-Magnetic Engine.
45 Garden Fountain.
46 Electrical-Machine.
47 On Levelling.
48 Plan for Guiding Balloons.
49 Gas Apparatus.
50 Gas Collector.
51 Register Thermometers.
52 Wheel and Pulley.
53 The Crank.
54 Water Alarum.
55 Potassium Apparatus.
56 Experimental Brick Beam.
57 The Crank.
58 Hotine's Shoemakers' Rounding Knife.
59 On Levelling.
60 Galvanic Batteries.
61 Hearing Trumpets.
62 The Lead Tree.
63 Automaton Ship.
64 On Timber Measuring.
65 Hydrostatical Paradox.
66 On Levelling.
67 On Electricity.
68 Instrument for Drilling Holes in Glass.
69 Pyrometers.
70 Drawing Instrument.


Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google